SCIENCE

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"THE PHYSICIAN OF TO-MORROW"[1]

MEDICINE now justly claims an important place with the other sciences. Phenomenal advance in the physical and biological sciences has revolutionized it and given it a definiteness hitherto lacking. In fact, it may be said that medicine has been born, or at least reborn, in the last quarter century. As a consequence, the new science is not yet oriented to those other forces in human environment and relationship which activate social and economic development.

Further, too, it is impossible to foretell with certainty the place of the medicine of to-morrow. Yet institutions charged with the responsibility of preparing medical practitioners, teachers and administrators for their duties in public medicine and in practise, fail in their obligations even when they furnish their graduates with all the necessary tools, if they neglect to provide proper perspective and to develop adequate capacity for the discriminating test of new methods and the proof of new truths which they will be called upon to adapt to their life work as it unfolds. Above all, these physicians of to-morrow must know humanity as well as human anatomy and physiology. They must be trained in the pathology of social conditions as well as in disease processes. They must be as expert in human relationships as in the habits of man's microscopic foes.

Whilst we recognize our limitations as prophets in forecasting the exact status of public and private medicine a generation

[1] Address delivered by F. F. Wesbrook, M.A., M.D., C.M., LL.D., before the Pacific Division, American Association for the Advancement of Science, San Diego, Calif., August 11, 1916.

in advance, we can feel confident that the evolution will be gradual and logical. The task of preparing our successors is difficult but not hopeless. We have opportunity to observe the trend of our own times and should seek to avoid for the next generation those faults and deficiencies so apparent in our own preparation.

It would seem that the first duty of every national government in respect to medical education and licensure is the collection and publication of accurate comparative statistics of the staffs, facilities, equipments and graduates of all its own institutions as a basis for comparison with each other and with those of other countries.

In the absence of such official information, the Carnegie Foundation for the Advancement of Teaching, a private and unofficial organization, in order to meet its own needs, undertook an international study of these matters and published a report on Medical Education in the United States and Canada in 1910 and a report on Medical Education in Europe in 1912. These reports furnish the first accurate information which permits comparison of the medical institutions in America with each other and with those of Europe.

So far as the United States is concerned, this involuntary and quite unofficial stock-taking has inspired official correction of conditions which it was first necessary for the public to know in order to cure under this democratic system of government.

Fortunately, these reports which were begun in the United States and Canada, have brought together the very material needed by all countries in planning for the future and we may be encouraged by the words of Mr. Flexner with which he begins his first chapter of the Report on Medical Education in Europe, when he says:

> Medical education has only of late deliberately set out to overtake medical practise.

If as a result of his thoroughgoing studies he is able to give us this assurance, we can be satisfied that we are already well on the way.

It is only a few years since the profession of medicine prided itself on the thoroughness with which it had reduced "minding its own business" to a science and the cultivation of aloofness to a fine art. Medicine was "holy ground." We have progressed so far, however, that we are now quite ready to agree with Dr. Pritchett's remarks on the occasion of the dedication of the hospital of the State University of Indiana,[2] June, 1914, when he advanced three main reasons why medical education is a matter upon which the layman has a right to be heard.

Firstly, he holds that medical education is primarily a matter of education and not a matter of medicine, in that it involves premedical as well as medical and graduate instruction and in fact the whole national training system.

Secondly, he cites the layman's own interest, since it is he who is made or marred by the medical profession and he therefore naturally wants to know how the members of the profession are trained. He furthermore has a right to public reports upon the ideals, standards, equipment, teachers and graduates of the various teaching institutions in order to exercise discrimination in the selection of his own physician.

Thirdly, he maintains that the layman is interested in medical education on account of his responsibility in matters of public administration. These involve not only public health work, with the control, suppression and eradication of disease, but the formulation and administration of laws relating to standards of medical education, graduation and licensure.

The protection of the general public as

[2] *Journal of the American Medical Association*, August 22, 1914, p. 648.

well as of physicians against overcrowding in the profession is urged on grounds of economy and efficiency by disinterested experts of education, sociology and public affairs, themselves not members of the medical profession.

Time will not permit us more than a glance at the state of affairs which is set forth in accurate detail in the reports mentioned.

The educational systems, primary, secondary, university and professional of Germany, Austria, France, England, Scotland, the United States and Canada have been carefully studied by Mr. Flexner. Attempt was made by him to measure all countries by the same standards and to analyze the conditions found.

Since the outbreak of this world war it is impossible to get accurate statistics, nor if available would it be possible under present abnormal conditions to judge from them as to the efficiency of the existing training mechanisms nor of the probable adequacy or otherwise of the available supply of physicians throughout the world to meet the demand as it was before the war, or as it will be at the conclusion of the war.

All of our standards have disappeared. Old things have passed away.

It seemed sufficient, therefore, for purposes of this discussion, to take those statistics which were available before the war, realizing, however, that *post bellum* evolution will probably be more accelerated than in *ante bellum* times. The following figures were taken largely from Flexner's reports and from the publications of the American Medical Association's Council on Medical Education.

GERMANY

Germany has only the one agency for the training of physicians, her state universities. Twenty-one universities have been in operation for almost a century. Her training system for all her citizens is continuous. There are no gaps and the state provides that training for each which appears most needed for each.

In an exhaustive article on "Continuation Schools in England and Germany," which appeared in the *Fortnightly Review* of February, 1914, Mr. J. Saxon Mills, a well-known British writer, calls attention to the superiority of the German system over the British system. He asks the pertinent question, "Wherein lies Britain's advantage in maintaining a two-ship power while she permits Germany to maintain a two-school power?" Her complete articulation of teaching and investigation with economic and military development has made her the power she is.

The German child goes to school from the time he is six until he is ten. He then enters the gymnasium, where he remains until he is eighteen. The gymnasium combines our school and university work and gives the old-time classical and humanistic training. Of recent years, the realschule and the realgymnasia have been established, in which the basic sciences are given and the classical and humanistic training correspondingly reduced. An increasing number of prospective medical and technical students are now choosing these latter courses instead of the gymnasium. Roughly speaking, graduation from the gymnasium, realschule or realgymnasium is about equivalent to the completion of our second year in a good American university.

Graduates of these three intermediate institutions are now ready to enter the five-year course in medicine afforded by the universities.

Flexner, who is himself an educationist trained in the humanistic school, realizes the rapid increase in the sum total of essential human knowledge and the consequent need for prolongation of the training

period. He discusses at considerable length the importance of early scientific training at the expense of the classics, and refers to several recent important conferences held in Germany in regard to the matter of a premedical education more scientific and less humanistic.

Five years of medicine and a sixth or hospital year permits the student to graduate at the average age of twenty-four years in Germany and his license is issued after a special examination.

All of the various teaching institutions are governmental and related. Graduation from the gymnasium, the realschule or the realgymnasium, where the examinations are conducted by the officers of those institutions, entitles the student to entrance into the university. Students are permitted to register in the university for classes which they may attend or not. When they have been registered in a particular subject for the requisite length of time, they may appear before the professor for examination. If successful, they are given credit for the subject, which is good at any one of the twenty-one universities.

A seeming weakness in the system is the lack of attention paid to sequence of subjects. A source of real strength, when properly controlled, is the migration of students from institution to institution whereby particular attractions in teachers, equipment, clinical or other opportunities are available to a student with some definite object in mind. The special attention paid to research work has enabled Germany to add her share to the world's medical and scientific knowledge, and in fact, had constituted her the Mecca for graduate work in medicine for the rest of the world. However, certain dangers arise from the undue stressing of research work, in that the undergraduate may come to be regarded by the professor as a necessary evil and only useful when he aids in the researches of the staff. This may be at the expense of his general medical training; in fact, the best medical schools of the United States and Canada were undoubtedly not surpassed in their undergraduate work by the German institutions.

Germany's special excellence was the uniformity of her training and the bringing of the whole profession up to a minimum level, which was for some time above that of any other country.

Some few figures in regard to Germany's supply of available physicians may be of interest. In 1885 Germany's population was 45,458,000. She had at that time 15,674 licensed physicians, or a ratio of 1 to 3,000. Her ratio before the war was about 1 to 1,912, varying from 1 to 637 in Munich to a ratio of 1 to 7,718 in Ortelsburg and other thinly populated districts.

Germany's work in the universities seemed entirely adequate to produce thoroughly equipped physicians of fairly uniform training faster than her population increases. The problem of adding new universities is one which is approached in Germany with great deliberation and careful study of population needs and of the universities already existent.

The facilities of German universities for medical teaching and research are familiar to most of us. Undue optimism, particularly in the United States, in regard to opportunities for medical study in Germany and Austria, had arisen on account of the special opportunities afforded visiting physicians. In many instances, instruction was given in English. Abundant material and opportunity were placed at the disposal of the visitor for a monetary consideration which seemed slight to the man in a hurry. On his return when he cited the opportunities which he had been given as showing the superiority of the German or Austrian medical school it usually suf-

ficed to restore his perspective when he was asked whether the German undergraduate students had shared the same opportunities or not. At once he readjusted his ideas when he realized that these graduate courses were often given at the expense of undergraduate training.

AUSTRIA

In Austria the state dominated in education as in Germany, although the mechanism was not so well developed. Conditions were complicated by the bi-lingual situation which demanded at times duplication of effort and expense without commensurate gain in efficiency.

The output of medical practitioners came from the five medical faculties of those universities where instruction is conducted in German. These did not seem to be sufficient for the work. Vienna particularly was overcrowded and the average enrollment in each of the five medical faculties was 736. Austria's population of 28,000,000 demanded the service of 13,202 physicians, a general ratio of 1 to 2,120. Since 1905 the population had increased about 4 per cent. and the practitioners about 6 per cent. Olmütz had a ratio of 1 to 390, whilst the other extreme was 1 to 5,081 in Carniola.

FRANCE

In France the universities under state administration set the standard of medical education and graduation, although medical schools of three different types were found. There were firstly, the eight university faculties, secondly, the schools "de plein exercise" attached to the hospitals in three cities which lack universities, and thirdly, preparatory schools attached to hospitals in 12 non-university towns. These schools offered courses to cover the first two years of the curriculum. In all three, as in Germany, the government appointed the professors, but from the German point of view, not even the French university faculties were built quite on university lines. The two types of accessory schools mentioned were isolated and lacked support, the state financing the universities and the municipality financing the schools.

The total enrollment of 8,850 medical students in January, 1911, consisted of 7,652 students in university faculties, 557 in schools "de plein exercise" and 570 in the preparatory schools. Paris alone had a registration of 4,101. The French student, like his German brother, was systematically trained, with his object clearly before him, so that his education was systematic and continuous. The medical student must have become a baccalaureat, which is the termination of the Lysée, an intermediate or secondary school comparable to the German gymnasium. He was then compelled to pass a year in the university science faculty in the study of preliminary sciences, which in Germany, Great Britain and Canada are illogically included as a part of the medical curriculum. The baccalaureate course and the certificate covering the study of physics, chemistry and biology issued by the university faculty of science, afforded the credential basis of the medical student in France. The average age of graduation in that country was twenty-three years, inclusive of hospital training.

France seemed to be in advance of other countries in insisting that the basis of medical education should be high and uniform and in addition that it be supplemented by thorough courses in those subjects required in the study of modern medicine.

Between 1881 and 1909 an increase of 30 per cent. occurred in the number of physicians, whilst the population of France increased only 10 per cent. Paris had one physician to 1,126 inhabitants in 1894 and 1 to 767 in 1908. The general statement

may be made that the profession in France, as in all other countries, was overcrowded in the city and undersupplied in the thinly peopled districts, because they failed to offer the inducement of a livelihood. Outside Paris the ratio was 1 to 2,360; in Lozerre it was 1 to 3,221.

ENGLAND AND SCOTLAND

In England premedical and medical education are very different from the German system. The following paragraph from the Carnegie report is of interest:

> In striking contrast with organized and systematized Germany are the conditions surrounding secondary education in England.

Mr. Flexner apparently had not the time at his disposal to enable him to become so thoroughly familiar with the complicated English individualistic plan as with the German systematic scheme, with its central and, from the administrative viewpoint, simpler control. He does not discuss the Scotch system of education, which for the average boy has long been much more easily accessible and systematic than in England. One who knows something of the British system can easily sympathize with the dilemma in which Mr. Flexner, an outsider, found himself. Perhaps one of the most striking examples of complexity is afforded by the relations and inter-relations of the various constituent colleges and departments of Cambridge or Oxford, where traditions, centuries old, often constitute the basis of procedure, private and public. Flexner mentions one instance to show the lack of uniformity of standards when he directs attention to a school whose sixth form admits to Oxford whilst it announces publicly that its fifth form prepares for Birmingham or Durham Universities. He could not understand how universities, even those situated in large cities, compete with secondary schools by conducting elementary classes for matriculation.

England and Scotland have twenty-seven medical schools, which is 29 per cent. more than in Germany, although the population is 40 per cent. less than that of Germany.

Considerable space in the report is devoted to the differences in British standards of admission, graduation and licensure, and the adequacy in general of the British examinations is commended. Mr. Flexner says: "Examination is a national industry; getting examined a national habit." I myself think the British examination is probably the main corrective against the lack of uniformity in standards and methods of premedical and medical teaching. The examination system brings many weaknesses and hardships. The English teacher, through fear of written external examination dare not train his boys, in the words of Sir William Ramsay, "to do something instead of know something."

The variation in the requirements for entrance into medicine in Great Britain is tremendous. The student may begin the study of medicine as a graduate in arts or science, or with mere university matriculation, or even on a level distinctly below that which would be demanded by a university for admission. And yet students from these differing educational levels are to be found side by side in all the London medical schools.

It is unnecessary to go into the details of organization and operation of the various medical teaching mechanisms of the universities, colleges, halls and other such institutions, or into the methods of examination employed by various universities, colleges and other bodies, many of which have not taught the students they examine.

Doubtless it seemed strange to Mr. Flexner to find graduates in arts of the Universities of Cambridge and Oxford, most of whom take their clinical work in the London hospital medical schools, re-

ceiving the same clinical instruction and working with the same ends in view, side by side with students whose premedical equipment, according to his opinion, would not have been too much to expect of an average fifteen-year-old boy. It has seemed strange to all of us, I am sure, why if in the opinion of the British authorities twenty-five years ago, it required a five-year training in medicine to prepare the students for the responsibilities of practise, it should not now require considerably longer time, on account of the tremendous increase in our knowledge of the basic and medical sciences and the clinical branches.

In 1891, there were 29,555 registered physicians in Great Britain, whose population at that time was 38,105,975, or a ratio of 1 to 1,289. In 1907 the ratio had become 1 to 1,107. Edinburgh showed a ratio of 1 to 489; the Yorkshire ratio was 1 to 2,057, if we omit thirty-nine towns of a population of 10,000 or upwards. Of recent years the average annual registration of licensed practitioners showed a decline in an attempt to adjust supply to demand. Had the medical profession realized earlier that medicine was not a thing apart, but only one of society's implements for its own betterment, on its own initiative it would have prepared in advance a scheme for its social and economic adjustment and the revolution of medicine precipitated some time ago by Lloyd George would have come as an evolution under the direction of medical statesmen.

In summary, Flexner discusses professional overcrowding in Europe in the following words:

> **The foregoing discussion appears to warrant the following conclusions: overcrowding of the profession takes place in Germany and Austria on a high, university basis, in England and Scotland on a low, proprietary basis.**

UNITED STATES

In 1910 the equipments, faculties and facilities for instruction and courses given were reported by the Carnegie Foundation in detail for 148 colleges, with 3,395 professors, 4,637 other instructors and 22,208 students. The Council on Medical Education of the American Medical Association had already been striving for several years by publicity to make known to the people the conditions within the profession, in order to furnish the basis for correction. Naturally, the general public in the United States, as in other countries, had not interested itself very much in medical matters, from which it had been excluded through mistaken policy on the part of the profession. At the time of the beginning of the council's work there were 164 medical colleges in the United States and 178 in all the other countries of the world. In August, 1914, the total number of medical colleges in the United States had been reduced to 107, through the pressure of publicity, whereas the number of medical students had been reduced from the maximum number in 1904 of 28,142 to 16,502. It was high time that this important work was undertaken, since even yet the number of physicians in the United States seemed to be increasing. The number of registered physicians in 1914 was reported as 142,332 and the population as 99,451,000, a ratio of 1 to 693.

At the time the Carnegie Report for the United States and Canada was published, I am convinced that the best undergraduate medical schools in the world were to be found in the United States, as also the worst. Dr. Pritchett, president of the Carnegie Foundation, in one of his comments says:

> **Faults of one sort or another may indeed be found in the medical schools of England, Scotland,**

France, Germany and Austria, but scandals in medical education exist in America alone.

He also said:

If the lowest terms upon which a medical school can exist abroad were applied to America, three fourths of our existing schools would be closed at once. And, let me add, the remaining fourth would be easily and entirely adequate to our need.

The Carnegie Report was unsparing in its denunciation of dishonesty and disparaged incompetence. Whilst frank in criticism of the best institutions, it did not fail to encourage good features whenever and wherever presented. The very criticism was constructive.

The publication of annual reports by the Council on Medical Education of the American Medical Association, grading the medical schools into several classes, has had a far-reaching effect.

But it is seen that action was not initiated by the national or state official or governmental machinery, but followed all too slowly on the heels of the tremendous effort at professional house-cleaning begun by the American Medical Association. This movement was extended by the Association of American Medical Colleges and internationalized on an economic and social basis by the Carnegie Foundation, all three organizations cooperating to bring about the much-needed reforms.

The Council on Medical Education of the American Medical Association reports annually the result of all the license examinations conducted in each state by the state boards in tabular form so that the percentage mortality from each medical college is shown. This Council and the Association of American Medical Colleges cooperate in the inspection of all colleges, particularly the doubtful ones and both by private helpful suggestion and by public criticism are putting the moribund institutions to a painless end and encouraging those for which there is hope as well as need. Their work could be done far more efficiently, however, by an official federal board.

There is an increasing tendency in the middle and western states towards strengthening state universities which seems inevitable if education is to be regarded as a state function at all. Medicine as a quasi-public profession, which is becoming every day more important in the social-service machinery of the state, must look to the state for its training, which is now so costly.

CANADA

Canada, too, has had and still has her problems in medical education. The Carnegie Report being American born, has not dealt as fully with Canada as with the United States, nor has it ventured so far into criticism, constructive or destructive, as in the case of American institutions.

The Carnegie Report shows that in 1910 there were 6,736 licensed physicians in Canada, her population being 6,945,228, the ratio being 1 to 1,030. The statistics for Canada and Newfoundland for 1912 show a registration of 7,278 physicians, which in 1914 was reported as 7,577, the increase being much greater than the population requirement.

The congestion promised to be even greater before the war. To the eight medical schools a ninth has been added in Alberta. In 1914 there were 2,001 medical students registered in Canada, whilst in the United States there were 16,502, or only eight times as many, although the population was more than thirteen times as great.

It is surely time for the public to know what the profession has long felt, namely, that we do not need *more* but *better* doctors. If Flexner, after careful study of conditions within and without the profession, regarded it as highly overcrowded in

Germany where there was an average of 1 physician to each 1,900 of population, he certainly was justified in believing that the United States had reached an unstable condition of affairs, since her ratio is 1 to 693, showing nearly three times as much overcrowding as in Germany and nearly twice as much as in Great Britain. Canada, before the war, was more overcrowded than any other country except the United States, her ratio being 1 to 984. As judged by the overwhelmingly large number of registered medical students, she bade fair in the near future to outstrip our neighbor.

Probably, however, the vast spaces of Canada require and will continue to require more medical men per unit of population than the older countries, particularly if she is to cure herself of that world-wide infection whose pathognomonic sign is "let the other man produce," and whose final stages are rural atrophy and urban hypertrophy.

In adapting supply to demand, the medical profession must not only continue to heal and prevent, to practise and to preach, but will be compelled to understand and to help solve those problems which are born of poverty and crime as a consequence of their relations with disease.

Specialization will be increasingly necessary to enable the individual physician to keep up with advance in knowledge. Postgraduate study in a system of continuation schools will be imperative and each state or provincial university will be shirking its duty if it does not cooperate with every other existing local agency in fostering and developing all available facilities.

With specialization comes inevitable demand for cooperation of the specialists and the group system may be expected to replace individualism. The splendid plan evolved by the Mayos, adapted to various environmental requirements, shorn of weaknesses and moulded on an increasingly public and decreasingly corporational basis, will spread. Contract work of groups on a public-service basis seems inevitable if the health and well-being of individuals is to be, as it must be, a matter of public concern and fundamental to national efficiency. The rural and sparsely settled districts need the best, not the worst, medical services and can not be ignored. This means increased importance of public medicine and expenditure of the funds of the wealthier districts through governmental administrative channels for their protection against the neglect or disabilities of the poorer districts, just as is now the case in educational expenditures. We must level up and not down, for we are indeed our brothers' keepers.

In the great influx of foreign population which may be expected on the cessation of the war, it is presumed that foreign physicians will also be amongst the newcomers. Rapid transit, ease of communication and all other annihilators of space conspire to make medicine, like commerce, international.

For these reasons and also because of the lessons to be learned I have ventured to direct your attention to a few of the conditions surrounding medical education in certain European countries.

In the Canadianizing and Americanizing of the millions of people whom we expect to come to us, we must have definite standards and we ourselves must expect changes in our existing standards and ideals, if we are to profit by the best which the newcomers bring us, eliminating our own worst features and placing a prohibitive tariff on theirs.

Of design, I have stressed the consideration of American conditions. The United States had at one time perhaps the worst medical training in the world and also the

best undergraduate medical teaching in its institutions. So she represented the two extremes.

As a result of publicity, the best schools have seized the psychological moment to improve themselves. The very worst schools are no longer existent. The United States availed itself of short cuts impossible to the older countries. It is therefore the part of wisdom for Canada to learn what can be gleaned from your recent wholesale changes, which are nation wide.

Our new country can save herself scores of years, and the pain and mutilation of those capital operations required in the older countries may be avoided by the exercise of care and foresight in this stage of her development.

A recent statement by Professor Adami, of McGill University, on the occasion of the inauguration of the president of Manitoba University, was startling, coming as it did from one who was born and trained in Great Britain and who has become the medical Nestor of Canada and the medical philosopher of this continent. In his address on medical research he called attention in detail to the advance of medical investigation and research throughout the world and laid emphasis upon recent developments in America, and perhaps on account of his innate modesty, particularly in the United States. He said:

> The center of medical research and education is moving rapidly westward and is now on this side of the Atlantic Ocean.

In view of our free hand and the twentieth-century tools available, we shall be wise to approach our task with care. That task can not be undertaken from a purely medical standpoint. There is no such thing. It must comprise a general educational betterment, a national, in fact a world program. We must adjust our public educational institutions so that the boys and girls are trained for practical affairs without loss of cultural and esthetic values. It is, after all, the manner of the teaching and the study as also the character and timber of the teacher and pupil which make for culture and efficiency. Knowledge is none the less scientific because of its possible application nor less cultural if useful. Our primary schools must be continuous with the high schools. Industrial schools must be established and the demands of agriculture can not be evaded. All of these must articulate with each other and with the university, so that at whatever point the pupil may be required to go out into his life's work, he may be as fit as he can be made in the time spent in fitting.

Continuation schools which cooperate with the public school system on the one hand and with the line of industry, commerce or professional work chosen by the pupil on the other must be provided, so that education becomes continuous for life and not a passing phase.

Systematic graduate work is just as necessary in order to keep medicine, law, theology, agriculture, commerce, journalism and the other professions in touch with the newer developments as is undergraduate training. University extension work which enters into all the activities of the people is growing in Great Britain and has been organized in many of the states of the union. Dr. Pritchett's statement is pertinent. He says:

> Education in any nation is one thing, not a series of separate and unrelated things.

Suitable exits from the educational system must be provided into the walks of life as well as into university courses and industrial schools. Studies in language on the whole should be begun earlier and continued longer, so that the student may be in a position to get some reward from his struggles with the dictionary and grammar

through an insight into literature and history. At the same time this would free the boys for studies in the basic sciences and the girls for similar studies and work in household economics and home-making and such other practical work as begins to appeal to them in the last years of high school.

In medicine the basic sciences begun in the high school should be continued in the university and constitute the chief object of the first two years' university training, which should be required for entrance into medicine. The studies should probably include, judging by your own observations on modern trends, physics, chemistry, biology and a reading knowledge of German or French, whilst advantage should be taken of the elective system to choose work in economics, sociology and human relationships, including the obligation as well as the rights of the ordinary citizen. Psychology should be available either here or as an elective in medicine after the foundation has been laid in the anatomy, physiology and pathology of the nervous system.

Considerable discussion has arisen over the demand of some American universities of the bachelor's degree in arts or science as a prerequisite for medicine. Harvard and Hopkins were the leaders and certain other universities have followed. However desirable it might be to medical students to take a previous arts or science degree, we must not forget that the rapid accumulation of knowledge concerning the science and art of medicine calls for a lengthening rather than a shortening of the medical course itself. Even with the increase in longevity which we fondly expect, we have to recognize that there is a limit to the formal training period. We must be practical and can not expect to spend longer time in training than the prospective doctor expects to spend in practise.

There is some sentiment for the inclusion of the so-called medical sciences, anatomy, physiology, pathology and bacteriology, with the arts or sciences in the university rather than in the medical college. This view is debatable. In any event, on the conclusion of the two years of work in the university preliminary to entering into medicine, plus the two years' work in anatomy, physiology, biology, chemistry, bacteriology, pathology, etc., the student is deserving of a bachelor's degree in science. Even should he discontinue his medical studies at this point, he has completed a course which fits him for work in many other directions and which has as great cultural and scientific value as many others which he might select for a science or arts degree.

Certain of the Canadian universities and some of the American, such as Minnesota, grant the B.A. degree to those who have completed three years in arts, inclusive of the sciences, modern language, etc., when the students have completed the first year's work in anatomy, physiology, bacteriology, etc. Such a course is to be recommended for the young man or woman who has the time or inclination for it.

In passing from one year to the next, certain students, deficient through illness, lack of application or other causes, may be saved the loss of a whole year by providing summer or vacation courses. These are very useful too, for migrants from other colleges, whose curricula are not identical with that of the new institution. On the whole, the best and most economic plan has been devised at the University of Chicago with the four-quarter plan, whereby the university is in continuous session. Modern economic efficiency demands that expensive plant and equipment be used to their fullest capacity. The human element, *i. e.*, staff and students, alone require rest.

In regard to the training of the clinical

years, the present trend is toward full-time clinicians, as it has been toward full-time laboratory men for the medical sciences, thus placing the whole university mechanism on a university footing. Johns Hopkins University has been the leader in this as in many other phases of medical teaching. Medicine, surgery and pediatrics have been placed on a full-time basis and the professors are not allowed to engage in private practise. Pay patients may be treated by them in Johns Hopkins Hospital, the fees going to the support of the hospital, the professors being entirely dependent upon their salaries or private incomes. This is the most drastic step taken by any university in the world, not excluding Germany. Meanwhile the world looks on and if it is wise, reserves judgment.

Dr. S. J. Meltzer, of the Rockefeller Institute, in Science for October 30, 1914, has a most interesting and important article on "Headship and Organization of Medical Departments of First Class Medicl Schools." He proposes to attain the ideal not by revolutionary steps because he says "Accelerated evolution gives better and safer results than revolution." For the clinical chair he proposes:

1. A head for this position, for whom the position should be his main occupation;

2. Two, three or more paid scientific assistants, for whom this position should also be their chief occupation;

3. Several professors and associate professors, etc., for whom these positions will be secondary occupations, their chief occupation being their private consultation or family practise. Some of these may receive moderate salaries;

4. An unlimited amount of unpaid volunteer assistants.

He thinks that all these positions should be appointments limited to varying periods of years.

He thinks the head should give about eight hours a day to his main calling and that they should be his fresh hours, say from 8 A.M. to 4 P.M. After these hours he may do with his time as he pleases. "But he should have no private patients in the hospital in the department of which he is the head."

Proper clinical teaching is only possible if teaching institutions own or completely control hospitals which are ready to discharge their double function. This double function involves the care of the patients of to-day and, not less important, the better care of the patients of to-morrow through teaching and research. Hospitals should not be simply boarding houses for the sick but institutions for research, study and teaching. Fortunately both these ends, viz., care of patient and teaching, are best served by the same plan.

The best results are obtained where the university owns its own hospital which is conducted primarily as a teaching and research institution. This safeguards at the same time the best interests of the patient. By arrangement with municipal and other public bodies, university medical schools may assume sole responsibility for the professional conduct of municipal or semi-private hospitals, guaranteeing the best possible service, but such hospitals can not easily be made integral parts of the teaching plant of a university. They should be accessory. Provinces and states will find the truest financial economy in coordinating their state universities with state hospitals and other state institutions of all kinds. Around the state university may be grouped the state hospital for the care of medical, surgical, obstetrical and special cases; one or more of the state institutions for the cure of tuberculosis and the care of the incurable, and a state receiving department for the observation and classification

of acute mental cases preliminary to assignment to the state institutions for the insane. All of these institutions, including correctional and charitable organizations as well, should be mutually related to each other and to the university, so that the experts of each may be available for all.

The governmental public-health mechanism should take advantage of the university experts in investigational and research work for legislative and administrative control. This is applicable also to other departments of the government. The university activities should be limited, however, to teaching, investigation and research and should stop short of legislation, administration and police control.

It seems certain that we can not compress the training of the physician of tomorrow into less than a four-year high-school course, plus two years of university work which shall include the basic sciences and a modern language, plus two years of medical science, and two years of clinical instruction, followed by a compulsory year in an approved hospital in interne service. Minnesota was the first school in the United States to take this step. At the conclusion of such training, the student should emerge with his arts or science degree and the medical degree.

We are now confronted with the matter of licensure, the ultimate safeguard which the public should demand for its own protection in addition to the standards of teaching which it enforces in its own provincial or state universities. A federal licensing board is best. It, like all licensing boards, however, should provide searching practical examinations in addition to written and oral tests.

The examination conducted by many of the state medical licensing boards is farcical in the extreme. The appointments are given all too frequently for political or personal reasons to men who are unfitted by natural aptitude, training or temperament for this exacting work. The United States might well take a leaf from Great Britain's book with respect to the conduct of examinations for licensure, whilst the latter might follow, with profit, the example set by this country in the matter of improvement in medical teaching.

Such boards should demand, as a minimum the amount of training specified above. The constitution of the board is a matter which requires careful thought. In the long run, I am convinced that the responsibility for its personnel should be placed upon the government and not upon the profession. If we are to avoid the public and private suspicion that the medical profession is a sort of trades union, the appointments should be made by the government. If our system of government is sound, this is the logical step. If not, our government needs change and we, as citizens, have been neglecting our duty. The prime consideration is that the standards of medical teaching and medical licensure are for the protection of the public and not for the protection of the profession. Licensing boards must take account of the teaching institutions in their own and other countries, and some governmental, in fact international, clearing-house arrangement be made for the careful inspection and accurate report to all the world regarding the facilities, equipment and standards which exist in all countries. A state or province or country can protect itself best from undesirable additions to its medical profession from other communities and other countries by insisting upon one standard for all.

In view of the present trend towards the socialization of medicine and the increasing importance of public health, together with the over-supply of physicians, immediate attention should be paid to the training of public-health workers and the development of adequate public-health machin-

ery, which provides work, pay and authority commensurate with the responsibilities which the workers are expected to assume. It means training in the sciences fundamental to medicine, in diagnosis and in certain branches of sociology, law, economics, engineering, etc., and can not be undertaken in a medical school but in a university which has full faculties and in a state or province where all public institutions are coordinated and work in cooperation.

The history of Johns Hopkins Medical School is significant. Medical teaching there grew out of the graduate medical teaching which had developed in the hospital.

Our faces are turned toward public medicine. If the profession accepts this as inevitable and also desirable and the public realizes its opportunity and responsibility, the change may be brought about as an evolution, rather than as a revolution. Instead of developing more medical schools to meet a demand which does not exist, society should unite in strengthening those which have shown a progressive spirit and some realization of the medicine of to-morrow. The rational evolution of the medical school would be the development at universities which are adequately equipped, of schools of public health in which all of the faculties of the university participate. It simply means the re-grouping of certain existing university departments as a committee under the name of a "School of Public Health." New universities have a particularly good opportunity in the foundation of such schools to help orient some of the medical graduates, who have failed in practise to adapt themselves to present conditions.

Our overcrowded profession has in it many men who would welcome the opportunity to secure freedom from the commercial aspects of practise. Many are better fitted for public service than for private practise. Such men could be trained by such a mechanism, for certain phases of public health administration. Others, for their own sake and the sake of humanity should receive further training in the practise of medicine and others should be excluded from the profession for which they are unfitted, or have failed to fit themselves. It would be some time before *all* of the present graduates in medicine could be intelligently utilized. When the demand has caught up with the supply and new medical schools are required, they will naturally evolve from such graduate schools, in this case of public health, instead of as the Hopkins did from a graduate medical school. Such public health schools would inevitably become more specialized and if private practise, as we have known it, persists, it could be logically related to and become the natural outgrowth from such public-health colleges.

Our profession has to play the part of social pioneer in demonstrating the inevitability of specialization and the need of cooperation between and coordination of specialists. We have not realized, however, that all of the workers in the medical field do not require and should not receive the same training. The public has long recognized that a short course of three or four months is insufficient for the training of specialists and there is an increasing interest within and without the profession in the development of adequate facilities for graduate training of those who desire to enter a particular medical field, *i. e.*, to become specialists. If an additional training period of two or three years is required for such a purpose in addition to the six to eight years required now by various medical schools and licensing boards, it is clear that great expenditure of time and money is demanded of the would-be specialist and he has a right to expect a fair return on his investment. Will anything less than

free opportunities for training and the entire taking over of medicine by governmental mechanisms, solve these difficulties, is a question which many are asking.

It seems that it would be most easily possible to coordinate the different elements in medicine in groups on a governmental, rather than a corporation basis.

It is necessary to provide each community, no matter how remote, with a group of trained medical men in which each special field is covered and the work of each properly related to the others.

The general practitioner and the family doctor seem doomed to disappear. No single individual can hope to keep abreast of new knowledge in all branches. Such a plan is for the best interests of the individual, the public and the doctor, and is in line with the trend of the times, which seeks to make of each citizen an expert in an increasingly circumscribed field. An agreement could easily be made whereby each member of the group in turn could get away to some of the continuation schools to bring himself abreast of the latest advances in his chosen work and carry back inspiration to his colleagues.

Whether this group system is a part of a municipally or a state or a nationally controlled mechanism can not be foreseen. Whether it will evolve through a corporational or state health insurance can not be foretold. Life insurance companies, railway and mining corporations and other similar organizations are drifting into makeshift arrangements which have these objects in view. In any event commercial concerns are realizing a little of the huge tax on the world of sickness, and the increasing load which the well assume in caring for the state dependents.

If medical school inspection is such a good thing, why should it not be extended to embrace society as a whole?

As this group system develops, it will be found that all the members of a group so constituted will not require the same training nor will some of the individuals require to be trained as long as certain others. For instance, all might have the same basic training, and employment could be found under competent supervision for those with the minimum training until such time as they had opportunity to demonstrate aptitudes. They could then be returned for certain formal training to graduate institutions so as to fit them for the new line to which they aspire and for which they have shown capacity. This would be a sort of continuation school in medicine whereby the original medical science instruction in laboratory, in clinical and in various public health phases could all be related to each other and to practise.

No one of us can see clearly the outcome. He sees indications of a coming change and, in many instances, instead of adapting and preparing himself for such changes, resents them. Here is an opportunity for medical leadership. The public has been aroused. We must not fail to rise to the opportunity and meet the obligation.

The abolition of sectarian ethics and the adoption of one brand, based on the Golden Rule, will cure many of the ills of humanity. In passing, we may ask ourselves why we should have one standard of personal ethics, another for professional and business purposes and yet another for political ends. Why, when owing to specialization, each group becomes increasingly differentiated from other groups of workers and at the same time increasingly dependent upon them, should the members of a group so often stand by their fellows in that group against the best interests of all the groups? That medical men have stood together, quite often against the best interests of other social groups, has estranged and insulated them to such an extent that they

have lost individual and collective power in their attempts at the solution of the problems of society. This has, at the same time, been to their economic disadvantage.

Medicine is founded on the highest ideals which inspire human action. Its traditions are of the noblest. The relation of the patient to his physician is sacred. Nearly every individual looks upon some member of the profession as almost divine. Yet the public, which is composed of just such individuals, has been suspicious of the profession which has in it many hundreds of just such physicians. We realize that in order to cure, as well as to prevent disease, it is necessary to deal with humanity one at a time. Yet to-day we are facing, as never before, the problem of harmonizing the individual's obligations and rights with collective needs and mass efficiency.

The greatest asset of the individual, as of the mass, is physical efficiency. Yet we can not solve our present problems in terms of the medicine of the past. The physician's problem, as it involves himself and others, is not medical alone, or economic alone, but social. We physicians have to return to the ideal of our fathers in medicine, which is that of service. We must go on in our search for new means of preventing and curing disease. We must employ these means for the benefit of humanity. In our interest in the details of this work, we must not lose sight of the increased complexities of those whom we seek to serve. We must either adapt ourselves and our profession to the ever-increasing needs of humanity, or expect that they will be adapted for us by others, who are less sympathetic with our traditions and aims. We must not stand aloof. We must develop leadership within the profession, which is only possible to those who understand the spiritual, intellectual, social and economic needs and problems of those whom they may seek to serve as well as they do their physical ills.

The day for American leadership has dawned. If she realizes it she may go further than any other country has yet been able to go, and one of her greatest opportunities is in the orientation of medicine with other social forces.

To her is proffered the honor of gaining universal recognition of medicine as the highest calling whose motto is "I serve." Will she accept it? Has her medical profession the needed vision and strength? Will her people receive such leadership kindly?

The agony which the world is enduring will have been suffered in vain if we can not learn how to develop the best that is in each of us for the advantage of all. Is not the world at war to determine whether the greatest right of every man is that of serving others, or of being served? We are now adjusting our perspective of obligation on the background of individual right.

F. F. Wesbrook
University of British Columbia

DEDICATION OF THE NEW MUSEUM BUILDING OF THE CALIFORNIA ACADEMY OF SCIENCES

The dedication of the new museum building of the California Academy of Sciences and the formal opening of the museum to the public occurred on Friday afternoon, September 22. The dedicatory exercises were held in the California Mammal room, a hall 180 feet long by 60 feet wide.

Mr. C. E. Grunsky, the president of the academy, presided. The invocation was by the Right Reverend William Ford Nichols, bishop of California. Brief addresses were made by the following: Mr. William H. Crocker, president of the board of trustees; Mr. C. E. Grunsky, president of the academy; Mr. Edward Rainey, for the mayor; Mr. George Haviland Barron, curator of the Memorial

Museum, San Francisco, for the board of park commissioners; Dr. David Starr Jordan, chancellor emeritus, Stanford University; Dr. Barton Warren Evermann, director of the museum.

Mr. Crocker spoke feelingly of his long connection with the academy, as president of the board of trustees continuously since 1898, or 18 years. Before him his brother, Charles F. Crocker, had occupied the same position for a number of years and his father, Charles Crocker, was deeply interested in the academy.

As president of the board of trustees, Mr. Crocker formally dedicated the new museum building to the advancement of the biological and physical sciences and the educational interests of the city of San Francisco and the state of California. He then turned the building over to the academy.

Speaking of the history and the aims and ambitions of the academy, President Grunsky said, in part:

Organized in 1853, the California Academy of Sciences has now for 63 years been conducted along broad lines for public service. Membership in the academy at a nominal annual fee is open to all who are interested in the study or advancement of science. Its activities are directed mainly along educational lines in providing the material and opportunity for securing information on matters pertaining to the natural sciences; and second, along lines of research and study in the various subdivisions of the natural sciences.

There are those present to-day who will recall, and some who were active in, the activities of the academy while it was quartered in a building at the southwest corner of California and Dupont streets, and there are many here who have enjoyed and who have profited by the natural history museum and its accessories maintained for many years prior to the great disaster of 1906 on Market between Fourth and Fifth streets.

It would be needless to present at this time a review of the history of the academy and of the work done by it. Those who desire will find much of interest and of value in the published records of the academy's proceedings.

It would be futile to give a due mead of credit to those heretofore connected with the work of the academy whose contributions have borne fruit, and whose achievement is expressed in some measure in the museum plant now to be brought closer to the general public. It must suffice to say that at all times in the history of the academy there was a group of enthusiastic scientific workers—with changing personnel—who stood ever ready to make, and did make, the sacrifices and put forth the personal effort which made the work of the academy worth while.

In the matter of publications, as in the case of its other activities, the academy has had to accept the limitation upon its output made necessary by the lack of adequate funds. Much has been left undone which ought to be done. Time will not, however, permit me to take up this matter for full presentation. Let me call attention merely to one fact which will be patent to all who look carefully into the affairs of the academy. The field in which the academy is active is but imperfectly covered; nor can it be covered as it should be without adequate support from those of means who, in furthering the aims of the academy, will not alone be benefiting our city and commonwealth, but will be contributing to the sum of human knowledge.

The building which has here been erected and is to-day being dedicated is located upon public ground. The academy has invested in it $183,000. Yet this building, while it is an earnest of what the academy is willing to do for the public, represents, in area occupied, only about one third of that of the museum building, which we hope some day in the near future will be completed on this site.

To accomplish the incomplete work with which we desire you to become better acquainted, the academy has taxed its resources as far as seemed wise and has made it possible to open to the public, housed in the first unit of its museum building, certain exhibits which will forecast what it is hoped may ultimately be adequately accomplished. There should be here assembled material from the Pacific Ocean and its shores representative of all the natural sciences, more complete than can be found elsewhere. It can be done and will be done, but not without outside aid. The resources of the academy, chiefly the result of bequests and endowments that will be referred to later, are limited and our installations and facilities for housing material always obtainable in abundance must progress slowly unless the academy can count on the generous assistance of those who have the means.

We can not at this time announce when our building will be extended. More material for re-

search and exhibition has already been collected than we can properly display. Some of the most striking habitat groups that should be at once installed must wait until more funds are provided and in some cases until the time has come when we can add to the building.

It has been suggested that the academy should extend its activities by assuming the management of an aquarium. I think I speak for every member when I say that the academy is ready to do this. But even though there are those of our citizens who may be willing to erect and equip the necessary buildings the academy is not so circumstanced that it can provide the funds for maintenance and operation. But its staff and its organization including the services of its director of the museum, Dr. Evermann, an expert in matters relating to fishes and the fisheries, are ready to help and will help. San Francisco should have an aquarium filled with the life of the Pacific Ocean and of the streams discharging into the ocean, second to no other aquarium in the world.

The academy has asked you to be present to-day at this dedication of the first unit of its museum building in order that you may become better acquainted with the academy's aims and purposes and as a reminder to the public that the academy is here to benefit and serve the whole community.

It is appropriate that at this time attention be called to the generous aid which the academy has received in the past and to that which it is now receiving in its plans for an enlarged field of usefulness.

It should be remembered that the academy is in Golden Gate Park with the consent of the people of San Francisco, who have seen fit to increase the academy's opportunity for service by permitting the erection here of the necessary museum buildings. This consent was given in 1910 and ever since that time the plans have been under consideration and in execution which are to-day beginning to see fulfillment.

By bequest of James Lick forty-one years ago, the academy became the owner of the Market Street property between Fourth and Fifth Streets on which for many years a museum of natural history was maintained. This property now in use for business purposes is the academy's present main source of income. The Lick bequest is now carried on the books as an asset of $802,000.

In 1881 the academy received from Mr. Chas. Crocker an endowment of $20,000, the income from which is to be used in aid of scientific research.

Mr. John W. Hendrie in 1899 bequeathed to the academy the sum of $10,000, the income from which has been set apart for the publication of scientific papers.

The late Wm. Alvord bequeathed to the academy the sum of $5,000, to be used in improving and adding to its herbarium.

During the last decade, while husbanding its resources, and collecting the material which is now assembled in the building being dedicated to-day, the academy affairs have necessarily received but little publicity and there has been but little opportunity for the public to become acquainted with its activities; nevertheless, the academy has been selected by many who have collected material of scientific value as the proper institution to preserve the same and make it available for the public. Attention will be called to only a few recent donations the announcement of which is appropriate on this occasion.

Our generous public-spirited fellow citizen, Wm. M. Fitzhugh, has, by purchase and additions thereto, preserved in its entirety the collection of Indian baskets, ornaments, implements and related material made in their lifetime by the late Professor and Mrs. T. S. C. Lowe, of Pasadena. This collection of exceptional interest and magnitude, which would otherwise have been scattered and would have lost value by piecemeal sale, is on display in the academy museum as a loan and merits your careful attention.

The most important gift which the academy has recently received is that of the Henry Hemphill collection of marine, freshwater and land shells. This magnificent collection, the making of which engaged the attention of Mr. Hemphill during practically all the years of his long and useful life, and which contains between 60,000 and 70,000 specimens representing more than 12,000 species, has been donated to the academy by Mrs. Charlotte Hosmer, daughter of Mr. Hemphill. The academy feels grateful to Mrs. Hosmer for this most generous gift.

The installation of the bird-habitat groups which are to-day being opened to your inspection and which will contribute much to the education and enjoyment of the public has been made possible by the liberality of three other San Franciscans as follows:

Mr. Wm. H. Crocker has presented to the academy the Farallon Islands bird group.

Mr. J. D. Grant has presented to the academy the San Joaquin Valley bird group.

Mr. W. B. Bourn has presented to the academy the Desert bird group.

It is their wish, as it is the wish of every one in any way connected with academy activities, that these exhibits, and the others, now to be opened to public view, may prove instructive and inspiring and a source of lasting enjoyment to all of those who care to avail themselves of the privilege, open to all, of visiting the museum.

To these donors and to all who have contributed to the service value of the academy, the academy, through its president, expresses its sincere appreciation and gratitude.

The academy welcomes such aid in the accomplishment of its aims and will ever be ready to accept and manage any trust having in view the advancement of science.

Mr. Rainey, representing the mayor, and Mr. Barron on behalf of the board of park commissioners, spoke of the great benefit which the museum of the California Academy of Sciences will be to the people of San Francisco. The location of the museum in Golden Gate Park, the most beautiful "people's playground" in the world, is a guarantee that it will be visited not only by our own people, but by all who come to San Francisco.

Dr. Jordan spoke of the value to general education and to science of natural-history museums. He called attention to the eminent position already attained in the field of scientific research by the California Academy of Sciences, and the prominent place the academy is destined to fill as a scientific educational institution.

In a reminiscent way, he told of his many years' connection with the academy, as president in 1896 and 1897, and again in 1900 to 1902, of his first visit to the academy in 1879, and his pleasant meeting at that time with W. G. W. Harford and Dr. Albert Kellogg the botanist and one of the founders of the academy.

Dr. Evermann spoke in part as follows:

In the few minutes allotted to me I shall be able to speak briefly of only one or two of the museum's activities and aims.

The California Academy of Sciences is a scientific, educational institution. As a scientific, educational institution, the academy, through its museum, has two important functions. The first of these is that of *scientific research*. The museum must furnish men and materials and facilities for scientific investigation. Through its research collections and its field investigations, it must study and solve its share of the multitude of scientific and economic problems which the physical and biological sciences, particularly those presented by the zoology, botany and geology of western America and the broad Pacific. We must do our share in studying and investigating and making known the natural resources of our country. The academy must contribute its share to the world's contributions to human knowledge.

The second important function of the academy is *educational*. The academy must do what it can within its means to be of real service in an educational way, not only to the general public, but also to the public and private schools.

One of the ways in which it is endeavoring to render educational service is by installing in this museum habitat groups of Californian mammals and birds and other exhibits that possess real educational value and which show the natural resources of the state.

Scientific research requires money and men. Habitat groups such as we are able to show you to-day also cost money.

The income of the academy is limited; it is not sufficient to enable the museum to carry on the scientific work which it should do and also build up popular educational exhibits.

We have been able to prepare the splendid exhibits which we have to show you to-day because of the generosity of a number of public-spirited citizens of San Francisco and by curtailing somewhat for the time being the scientific activities of the academy. Without the help of these friends of the academy the valuable and attractive exhibits we have now installed would have been fewer in number. Nor would there have been so many if we had not drawn upon the academy's funds for scientific research.

We have planned for several additional large habitat groups. We even have the animals on hand for a number of them. I may mention the very interesting elephant seal, a remarkable species of large marine mammal now nearly extinct. We have the animals for the group, but need funds for installing them. We have also the animals for two or three deer groups, a gigantic tortoise group, and a large iguana group. We have planned also for 22 groups of small California mammals, a dozen small bird groups similar to the very beautiful California quail group which you will see in the bird hall, and an indefinite

number of small portable habitat groups such as that of the western meadowlark, which may be seen in the office upstairs. These we propose to loan to the public schools should they desire them.

It is hoped that the necessary funds for these exhibits may be supplied by private donations, so that the net regular income of the academy may be reserved chiefly for scientific research. The large groups cost from $3,000 to $4,000; the small groups about $500 each; and the portable educational groups about $100 to $250 each.

It is hoped that this opportunity to do something worth while may appeal to those who are interested in education and who have the means to help along in such excellent work. What a splendid thing it would be for San Francisco and the state if, among those present here to-day, there might be some so impressed with the opportunity to help in this good work that they would provide the means to enable the academy to add a dozen or more groups to the excellent series so well begun. We have the expert taxidermists and preparators to do the work; we need only the funds to meet the expense.

In conclusion, may I be permitted to mention one other need of the museum, to which I have called attention on another occasion.

It is my ambition that there shall be in this museum a *Children's Room*—a room in which will be displayed natural history objects such as are particularly attractive to little children. There would be in this room brightly and curiously colored birds and butterflies, moths and beetles and other insects; curious animals of other groups; attractive minerals, growing plants, and aquariums with interesting and instructive animal and plant life; colored transparencies of beautiful native flowers, all selected and arranged with reference to the telling of an interesting story, of teaching a definite lesson.

And there will be in this children's room a children's reading room in which will be found a library of all the interesting and reliable nature books and helps to nature study.

And there will be in charge of this children's room a well-educated, kindly, sympathetic man or woman who knows animals and plants; who knows the specimens in the museum and the live things in the park about it; and who, above all, knows and loves children; a man or woman who can wisely direct the observation and the reading of the children so that they may correlate their reading with what they have seen in the museum or in the open, and thus increase rather than stifle their interest in, and love for, animate things, as our public schools almost invariably do. It will be arranged so that children of the different grades will come to this room at different hours, and receive the instruction and help and encouragement adapted to their respective needs.

And all this will be done and done soon, I confidently believe. It will be done because it so evidently appeals to us all as being the *right thing to do*, the right sort of education and training to give our children. It will be done, because the beauty and worth of it all, for the little children's sake, will appeal to some one who has prospered in this world; some one with a kindly heart, who loves children, and who wants to help them to become the men and women they should become; and some day that man or woman will come forward—I wish it might be to-day—and, out of his abundance, endow a *Children's Room* in this museum, and thus make it possible for the California Academy of Sciences to do this splendid work for the children of California, not only of to-day but for those of the years to come.

At the close of the formal dedicatory exercises a private view of the exhibits thus far installed was afforded the museum's guests, of whom nearly one thousand were present in response to the special invitation.

Large habitat groups have been completed of the following: San Joaquin Valley elk, black-tail deer (summer scene), mule deer (winter scene), antelope, desert mountain-sheep, leopard seal, California sea-lion, Steller's sea-lion, mountain-lion, black bear, raccoon and striped skunk, coyote, Farallon Islands bird rookeries, San Joaquin Valley water-bird group, and a desert-bird group. A California condor group is nearly completed, and small groups of the California Valley quail and western meadowlark have been finished.

A number of additional groups will be installed in the near future, as materials and funds become available.

That the museum of the California Academy of Sciences has at once taken a prominent and secure place in popular favor is evidenced by the phenomenally large attendance following its formal opening to the general public on Sunday, September 24, when 9,812 visitors were recorded. On each of the week

days following, the attendance has exceeded one thousand. The museum will be open to the public from 10 A.M. to 4 P.M. on week days and from 10 A.M. to 5 P.M. on holidays, including Sundays.

BARTON WARREN EVERMANN

SCIENTIFIC NOTES AND NEWS

THE National Academy of Sciences will hold its autumn meeting in Boston and Cambridge on November 13, 14 and 15. The William Ellery Hale lectures will be given on Monday evening and Tuesday afternoon, by Professor Edwin Grant Conklin, of Princeton University.

THE first lecture of the Harvey Society for the present season was given on October 14, at the New York Academy of Medicine, by Dr. J. S. Haldane, F.R.S., of Oxford on "The New Physiology." This lecture will be printed in SCIENCE.

THE degree of doctor of laws was conferred upon Thomas A. Edison over the telephone by Dr. John H. Finley, president of the University of the State of New York, at the closing session of the institution's fifty-second convocation on October 20. Mr. Edison was in his laboratory at Orange, N. J., while Dr. Finley was in the auditorium of the New York Education Building.

DR. GEORGE W. FIELD, of Sharon, Mass., chairman of the Massachusetts Commission on Fisheries and Game, was elected president of the American Fisheries Society at the concluding session of its forty-ninth annual convention, held in New Orleans on October 18.

DR. PERCIVAL LOWELL, of Boston, director of the Lowell Observatory at Flagstaff, Arizona, has been elected an honorary fellow of the Royal Astronomical Society of Canada.

MR. LOUIS R. SULLIVAN and Mr. Leslie Spier have been added to the scientific staff of the department of anthropology of the American Museum of Natural History. Mr. Sullivan will care for the skeletal and other somatological material in the department and will develop exhibitions showing racial differences and man's relations to the primates. Mr. Spier for the present will care for the archeological and ethnological collections exhibited from the eastern states.

WITH the cooperation of Harvard University and the Massachusetts Institute of Technology, the Barber Asphalt Paving Company has established at these institutions a fellowship for research in asphaltic materials and their uses. The fellowship is to be known as "The Clifford Richardson Fellowship." Mr. Richardson is an alumnus of Harvard, known for his contributions to asphaltic highway construction and the chemistry of bitumens.

PRACTICAL forestry management has developed to such proportions in Massachusetts, under the administration of State Forester Rane, that it has been decided to establish a state forestry office in the western part of the state for the convenience of land owners in that section. C. R. Atwood, who is a graduate of the University of Maine, and for some time has been an assistant to Paul D. Kneeland in the Boston office of the state forester, has been selected for the position. He will have headquarters in Springfield.

S. B. Fox, Ph.D. (Cornell), has been appointed assistant in farm management on the experiment station staff of the Montana State College.

THE American Museum of Natural History had three expeditions for fossil vertebrates in the western United States during the past summer. All report a fair degree of success, especially in the discovery of new and interesting fossil faunas. Mr. Barnum Brown, in charge of the expedition for Cretaceous dinosaurs in Montana, reports the discovery of Cretaceous dinosaurs distinct from those of the localities hitherto explored by the museum, and perhaps representing an older stage in their evolution. Mr. Walter Granger reports the discovery in a new locality in New Mexico of numerous remains of small mammals of an age intermediate between the Torrejon and Wasatch horizons. Mr. Albert Thomson has continued work in the Agate quarry, securing additional material needed for the group planned to represent this quarry fauna and has also secured interesting material from the Pliocene beds

farther south. Dr. W. D. Matthew was with Mr. Thomson's party during the early part of the season, engaged chiefly in an extensive reconnaissance of the later Tertiary fossil beds in western Nebraska. Professor H. F. Osborn joined the party for a short time, visiting on his way some of the more important localities in Nebraska.

The University of Chicago paleontological expedition to northern Texas the past season, which was in charge of Mr. Paul Miller, of the department of geology and paleontology, secured some valuable material, which is now being prepared for exhibition in Walker Museum. Mr. Miller was accompanied by Messrs. Jillson and Bridge, fellows in geology. The most important of the specimens are several nearly complete skeletons of *Labidosaurus*. In northern New Mexico Professor S. W. Williston and his son spent several weeks exploring the Permian deposits along the Puerco River. He brought back the skull and a large part of the skeleton of a large carnivorous reptile, *Sphenacodon*. Dr. Williston also secured most of the skeleton of a smaller reptile, perhaps five feet in length, which is new to science.

The expedition from the American Museum of Natural History to Nicaragua, under Messrs. Clarence R. Halter and L. Alfred Mannhardt, will remain in the field until January. Scientific collections of reptiles and fishes have been made from the eastern coastal belt—and shipments north of living specimens of *Basiliscus* and *Caiman* are being prepared for use in the reptile group work of the museum. The expedition will now carry the survey into the mountains of the interior, to Lake Nicaragua, and the western coast.

"Aspects of Modern Science" is the general subject of a series of lectures being given under the auspices of the University Lecture Association in cooperation with the University of Chicago. In the Oak Park center of the association, on October 16, Professor Edwin Oakes Jordan, chairman of the department of hygiene and bacteriology, gave the fourth lecture in the series, on the subject of "Bacteria and the Prevention of Disease." On October 25 Associate Professor William D. Harkins, of the department of chemistry, spoke on "Radium, the Breaking-up of Atoms, and the Evolution of the Elements." The final lecture in the course will be that by Professor Rollin D. Salisbury, dean of the Ogden Graduate School of Science, on the subject of "The New Geology." The series was introduced by Professor Robert A. Millikan, of the department of physics, who discussed "Modern Views of Electricity."

At University College, London, a series of six public lectures is being delivered by Professor J. A. Fleming on "Long-distance Telegraphy and Telephony."

Professor A. J. Carlson, of the University of Chicago, lectured in Toronto before the Academy of Medicine, on October 3, on "Some Recent Studies of the Physiology and Pathology of the Stomach."

A statue of Robert Koch was recently unveiled at Berlin, six years after his death.

Virgil Gay Bogue, of New York City, widely known as a civil engineer, died on October 14, at the age of seventy years.

The thirty-fourth stated meeting of the American Ornithologists' Union will be held at the Academy of Natural Sciences, in Philadelphia, November 14–16, with a business meeting of fellows and members on the 13th.

In anticipation of a possible epidemic of poliomyelitis next summer, the Illinois State Board of Health has arranged for a number of conferences on the subject at different points in the state during the winter months.

Funds have been contributed which make possible the opening of the psychopathic laboratory at the New York City police headquarters. This laboratory was opened last December in order to cull from the prisoners each day those who were mentally defective and to send them to suitable institutions. The list of those subscribing to the support of this laboratory include Andrew Carnegie, F. W. Vanderbilt, Daniel Guggenheim, Mortimer L. Schiff, William Rockefeller and Mrs. George B. Alexander.

Director W. T. Hornaday, of the New York Zoological Park, announces that the fund to

erect a building to house the Zoological Society's national collection of heads and horns had been raised. The building will be built in 1917 and opened to the public in the spring of 1918. The fund is made up of ten subscriptions of $10,000 each, the donors being Mrs. Frederick Ferris Thompson, Mrs. Russell Sage, John D. Archbold, Jacob H. Schiff, George F. Baker, Mrs. Louise W. Carnegie, Andrew Carnegie, Edmund C. Converse, Samuel Thorne, and two others who signed themselves, respectively, "In Memoriam" and "A Friend."

THE *Journal* of the American Medical Association notes that the *Therapeutische Monatshefte* for September arrived on October 8, the first German medical journal to reach its office since early last May. Before the war twenty-six German journals were indexed regularly. The German medical journals are being published regularly, as abstracts from them appear in the Scandinavian and Netherlands exchanges.

THE celebration on June 13 in connection with the centenary of the Botanic Gardens, Sydney, are noted in *Nature*. Speeches were delivered on the occasion by the governor of New South Wales, the premier, and the minister for agriculture, and a brief historical address was given by Mr. J. H. Maiden, F.R.S., the director of the gardens. Three vistas were named, respectively, after Capt. Cook, Sir Joseph Banks and Governor Phillip, and a rosery is to be known in future as the "Centenary Rosery." The following memorial trees were planted simultaneously by representatives of the Empire and the Allies: Great Britain and Ireland, the British Oak (*Quercus pedunculata*); Australia, the Bunya Bunya (*Araucaria Bidwilli*) and the Flame Tree (*Brachychiton acerifolia*); Sydney, the Port Jackson Fig (*Ficus rubiginosa*); New Zealand, the Kauri (*Agathis australis*); South Africa, the Cape Chestnut (*Calodendron capensis*); Canada, the Sweet Gum (*Liquidambar stryraciflua*); India, Indian Date Palm (*Phoenix sylvestris*); Belgium, Black Belgian Poplar (*Populus monilifera*); France, Nettle Tree, or Perpignan Wood (*Celtis australis*); Russia, the Aspen (*Populus tremula*); Italy, Lombardy Poplar (*Populus nigra*, var. *pyramidalis*); Serbia, the Carob (*Ceratonia siliqua*); Montenegro, the Olive (*Olea europæa*); Portugal, Portugal Laurel (*Prunus lusitanicus*); Japan, Japanese Maple (*Acer japonica*). A memorial stone of a proposed museum of botany and horticulture was laid.

THE National Forest Reservation Commission has approved the purchase by the government of 59 tracts of land with a total of 66,880 acres in the Appalachian and White Mountains. Of this, 36,000 acres is in the so-called "Kilkenny Purchase Area" in New Hampshire. It is the policy of the commission to build up government holdings, as nearly solid as may be, through buying only in certain specified places, which are designated purchase areas. The Kilkenny Purchase Area adjoins the so-called "White Mountain Purchase Area" on the north, and is on the watershed of the Connecticut River. The land now approved for purchase is the first to be acquired in the Kilkenny Area. About 17,000 acres of land on the White Mountain area was approved. This land lies for the most part on the west slope of the Carter Range and practically completes the government purchases in the northern portion of the White Mountain region. With this land a total of 698,086 acres in the White Mountains has been acquired. Smaller tracts were purchased in the southern Appalachian Mountains, the largest total on any area being that of 7,678 acres in Transylvania County, North Carolina, on the Pisgah Forest. Other tracts in Avery, Caldwell, Macon and McDowell Counties, North Carolina, on the Boone, Nantahala and Mt. Mitchell areas, aggregate 1,870 acres. Approximately 2,000 acres of the approved lands are on the Potomac, Shenandoah and Natural Bridge areas in Virginia; 956 acres are in Rabun and Union Counties, Georgia, and the remaining 586 acres are in Monroe and Sullivan Counties, Tennessee. Congress recently reappropriated the $3,000,000 of the original fund which was not spent in the beginning of the work and which consequently reverted to the treasury. This money, accord-

ing to the officials in charge, will be used mostly to round out the lands already acquired, so that they may be easily and economically administered. In making future purchases it is stated that the policy will be to select those tracts which block in with lands already purchased and which are offered at the most reasonable prices. The acquisition of lands was begun in 1911 under the so-called "Weeks Law," which permitted the government to purchase, for national forest purposes, lands on the headwaters of navigable streams in the White Mountain and Appalachian regions. To date 1,396,367 acres have been approved for purchase.

There has recently been organized, with headquarters at Minneapolis, The American Association for the Promotion of Technical Education in India. The purpose of the society is to promote the development of the American type of education in agriculture and the mechanic arts in India, by assisting Hindoo students who are in attendance at American universities and colleges in selecting their own educational training while here and in planning for service in industrial education upon their return to India. Local sections of the society have been organized at Pullman, Washington, and at Minneapolis, Minnesota; and others are in process of organization at other state institutions. R. W. Thatcher, assistant director of the Minnesota Agricultural Experiment Station, is acting-president of the association, and V. R. Kokatnur, a graduate assistant in the school of chemistry of the University of Minnesota, is general secretary. It is hoped that through the work of this association, the efficiency-ideal of American technical education may be introduced into India, and may serve to assist the Indian people in developing and utilizing their industrial resources, and so tend to prevent the frequent recurrence of the terrible famines of the past.

The *Journal* of the American Medical Association states that the Henry S. Wellcome prizes, offered through the Association of Military Surgeons, viz., first prize, a gold medal and $300, and second prize, a silver medal and $200, are open for competition to all present and former medical officers of the army, navy, Public Health Service, Organized Militia, U. S. Volunteers, Medical Reserve Corps of the army, navy and of the officers reserve corps of the U. S. Army. These prizes will not be awarded until after December 15, 1916, the council of the association having voted to extend the time of entry of competing essays to that date, because so large a number of the members are now with the troops on the border. Several essays have already been received and a large additional number are expected to be entered for such honorable and valuable prizes. The subject for the first prize is "The Most Practicable Plan for the Organization, Training and Utilization of the Medical Officers of the Medical Reserve Corps, U. S. Army and Navy and of the Medical Officers of the Officers' Reserve Corps, U. S. Army, in Peace and War." The subject of the second prize is "The Influence of the European War on the Transmission of the Infections of Diseases, with special reference to its Effect on Disease Conditions of the United States." Essays (five copies signed by nom de plume) not to exceed 20,000 words, exclusive of tables, must be addressed to the secretary of the Association of Military Surgeons, U. S. Army Medical Museum, Washington, D. C.

The Oberlin Geologic Survey spent the period from June 15 to August 3 in Southern Vermont, near the village of Wilmington. Two groups of students were organized, one for physiography and geographic work, the other for geologic work. The field chosen had been mapped by the topographers of the United States Geologic Survey, but no geologic or topographic map had been made. The rocks were found to be almost entirely metamorphic systems indurated here and there with dikes of basalt quartz and granite. No mineral deposits were found worth working-up, and great quantities of magnetite and tourmaline, and garnet in disseminated crystals were found. The rocks were mostly originally

estuarian sands, clays and calcareous beds. Dr. Hubbard devoted the remainder of the summer to working for the Ohio Geologic Survey, part of the time in the field and part of the time writing. The preparation of the *Bulletin* for the State Survey, in the physiography of the state of Ohio, is well advanced. It is hoped that the manuscript may be ready for the printer by next year.

Nature states that before the war Russian men of science, and especially biologists, had to send a very considerable proportion of their writings abroad for publication, and the German journals thus became the common medium for much of the best Russian work. Soon after the outbreak of war efforts were made to remedy this state of affairs; of the new journals, Professors Shimkewitch and Dogiel are editing the *Russian Journal of Zoology,* Professors Sewertzoff and Elpatiewsky the *Revue Zoologique Russe,* and Professor Dogiel the *Archives Russes d'Anatomie, d'Histologie et d'Embryologie.* The first number of the latter has just appeared. In spite of the enormous drain on Russian finances, the minister of public instruction made the publication of this journal possible by a government subsidy.

UNIVERSITY AND EDUCATIONAL NEWS

A GIFT of $60,000 for an observatory and 36-inch telescope has been given to the University of Arizona by a donor whose name is withheld.

THE University of Pennsylvania has received $25,000 from the estate of Anna Yarnall, the income of which is to be used for the maintenance of the Botanic Gardens of the university.

ROBERT W. KELLY, of New York, of the class of '74, has given $125,000 to the Yale Alumni Fund.

THE new ceramic engineering building of the University of Illinois is to be formally dedicated on November 20 and 21. It is expected that the exercises will be attended by many representatives of the architectural, structural, mining, geological, chemical and manufacturing interests. In connection with the dedication exercises an industrial conference will be held, in which a number of topics of current interest to the ceramic engineer, the clay-worker and the manufacturer will be discussed by well-known experts. The ceramics building is a fireproof structure three stories high and with basement.

THE salaries of all full professors at Brown University has been increased by $400. The minimum salary is now $3,000 and the maximum salary, except for administrative officers, is $3,650.

DR. ARTHUR R. EDWARDS has resigned as dean of Northwestern University Medical School. Arthur I. Kendall, professor of bacteriology, has been made acting dean.

DR. OTTO DUNKEL, of the University of Missouri, has been appointed assistant professor of mathematics at Washington University, St. Louis.

PROFESSOR WILLIAM H. KAVANAUGH, who has been a member of the engineering staff of the University of Minnesota for fifteen years, has resigned his position as professor of experimental engineering to accept a professorship in the Towne Scientific School of the University of Pennsylvania.

RALPH PATTERSON ROYCE, formerly livestock editor of the *Missouri Farmer,* has been appointed instructor in animal husbandry at the University of California Farm.

THE following appointments have been made in the laboratories of the University of Nebraska, College of Medicine, Omaha: H. E. Eggers, B.Sc., M.A. (Wisconsin), M.D. (Rush), professor of pathology and bacteriology; John T. Myers, A.B. (Washburn), M.S. (Kansas), instructor in bacteriology; Amos W. Peters, A.M., Ph.D. (Harvard), assistant professor of bio-chmemistry.

DR. ARDREY W. DOWNS, formerly professor of physiology at the Medico-Chirurgical College, Philadelphia, has accepted the chair of physiology at McGill University, Montreal.

PROFESSOR H. HAHN, of Czernowitz, has been appointed professor of mathematics at Bonn.

DISCUSSION AND CORRESPONDENCE

THE CENSUS OF FUR SEALS, 1914 AND 1915

Interest in the fur seals of the Pribilof Islands at the present time centers largely in the annual enumeration of the animals. Since 1912 a complete count of the pups born has been made each season, which constitutes an exact enumeration of the breeding females. In 1911 pelagic sealing, which had occasioned the herd's decline, was suspended by international treaty. The count of pups was instituted to secure an exact figure for the breeding stock at its lowest point and was continued to secure a measure of its annual increase.

Comparison of the figures for 1912 and 1913 showed a gain of 12½ per cent. This was approximately what was expected from the experience of many years in taking the annual quota of young male seals. Unfortunately the count of 1914 was made by men not previously experienced in the work and a new set of personal equations was introduced. The result gave a gain of only one per cent., without any adequate explanation for the irregularity. The results of the count for 1915, made by the resident agents on the islands, are now available, and, while they are affected by another new set of personal equations, this time an experienced one, a practically normal condition is found to exist; a gain of 11 per cent. in pups is shown over the count of 1914.

In the December issues of Science for 1912 and 1913 the censuses for these seasons were published. The census for 1914 appears at page 39 of Senate Document No. 980, the report of the investigating committee of 1914. The census of 1915 has not as yet been published. The figures of these two seasons may be contrasted with those for 1913 as follows:

Animals	1913	1914	1915
Breeding bulls[1]	1,403	1,559	2,151
Breeding cows[1]	92,269	93,250	103,527
Idle bulls[1]	105	172	673
Young bulls[1]	259	1,658	11,271
4-year-old bachelors[2]	2,000	9,939	15,848
3-year-old bachelors[2]	10,000	13,880	18,282
2-year-old bachelors[2]	15,000	17,422	23,990
Yearling bachelors[2]	20,000	23,068	30,307
2-year-old females[2]	15,000	17,422	23,990
Yearling females[2]	20,000	23,067	30,306
Pups of the year[1]	92,269	93,250	103,527
Totals	268,305	294,687	363,872

No particular importance attaches to the final totals or to the estimated groups in this table. The non-breeding animals can not all be seen together at any one time nor counted in any way. The estimates are based on assumptions regarding the mortality suffered by the different classes of animals on the winter migrations, and these assumptions are slightly different for each census. The important elements are the counted items, giving the three essential factors in the herd—the breeding females, the breeding males, and the reserve of male life—the idle and young bulls growing up.

Two facts of great importance are established by these counts. The first is that the herd has made a substantial growth in the years since pelagic sealing was abolished. The stock of breeding females which in 1912 numbered 82,000 now numbers 103,000. The suspension of pelagic sealing, accomplished by the treaty of 1911, has, therefore been effective in staying the decline and in restoring the herd to a condition of normal growth.

The second fact is that there has been an abnormal increase in the stock of reserve males. In 1913 this reserve was represented by 364 animals for an active stock of 1,403—an adequate reserve, since the breeding life of the male is six to eight years. In 1914, however, this reserve had advanced to 1,830 animals, more than equaling the active stock of 1,559. In 1915 it had advanced to 11,944 for an active stock of 2,151, giving a reserve of five times the active stock. The season of 1916 having now passed, the 15,848 four-year-old bachelors of 1915 have taken their places in this reserve, bringing it up to a total of about 27,000 animals, approximately ten times what the active stock should be. To this again will be added the 18,282 three-year-old bachelors of 1915, as reserve bulls of five years and over, in 1917. In that season the law which is occasioning this abnormal condition will have

[1] Actual counts.
[2] Estimates.

passed its first stage of complete suspension of killing, but it will go on for nine further years adding 4,000 unnecessary reserve bulls annually.

The harmful effect of this abnormal state of affairs is already beginning to be evident. Preliminary information regarding the conditions found in 1916 show a total of 3,500 harems on the Pribilof Island rookeries. In other words, while there has been a gain of about 25 per cent. in the stock of breeding females since 1912, there has been a gain of about 150 per cent. in breeding males. This is due to the pressure of idle bulls upon the breeding herd. The increase in this class of animals since 1912 is 2,280 per cent. These animals crowd into the massed rookery portions and establish small harems by capture, and their attempts to hold and augment these harems keep the breeding grounds in a constant turmoil to the injury of the mother seals and the trampling of their young. This condition will grow steadily worse as the young males now being released from killing grow to maturity.

More important still is the obscurity which this increasingly abnormal condition will throw over the vital facts of the herd—its normal rate of increase and the proper proportion of male life—which a prolongation of the normal condition of the last six or eight years, throughout the early stages of the herd's recuperation, would have cleared up. On this subject I may quote the following paragraph from my report to the Bureau of Fisheries in 1913:

> Unfortunately, if the suspension of land killing is prolonged, the balance will be broken. The herd will begin at once to enter upon a new era of abnormal conditions (like those of 1896–97). The pressure of the idle bulls will increase the number of harems without reference to increase in cows and the averages (resulting from the counts of pups) will become useless. The mortality among the cows and pups will increase frightfully, retarding the development of the herd. The work of rookery inspection and investigation will be rendered difficult and dangerous. The handling of the bachelor seals on the killing fields will also be attended with difficulty and danger by reason of the bulls which will necessarily be taken up in driving. Hauling grounds and breeding grounds will be overrun by a horde of savage, fighting bulls. The herd will go into eclipse and it will be fifteen or twenty years before it emerges from the darkness and begins to show normal conditions again. Its size will then preclude the possibility of counts or accurate estimates to enable those in charge to find a basis of understanding the herd such as we have to-day.

The condition thus warned against is now practically inevitable. The department of commerce, by accepting as "wise and sound legislation" the fur-seal law of 1912 and taking no step towards its repeal or amendment, has deliberately thrown away the opportunity to settle the two important facts vital to the future administration of the fur-seal herd.

GEORGE ARCHIBALD CLARK
STANFORD UNIVERSITY, CALIF.,
September 19, 1916

IS DYNAMICS A PHYSICAL SCIENCE?

PROFESSOR HUNTINGTON'S latest communication[1] helps to make clear the difference between his method of treating mass and the usual treatment. According to the ordinary view, such problems as the one proposed by me are solved very simply by the principle that *the mass of a body is the sum of the masses of its parts.* Although Professor Huntington does not give a general[2] solution, he indicates that his method also makes use of this principle of additivity, but only after it has been *proved* by an analysis involving internal forces, the law of action and reaction and the law of vector composition of forces. Apparently he is unwilling to assume as fundamental even the fact that the mass of a body is increased by adding matter to it. I have no logical objection to this procedure, but it seems to me to be an unnecessarily difficult method of introducing a very simple principle. It is to be noted, moreover, that the proof of

[1] SCIENCE, September 8, 1916.

[2] The general solution must cover any case whatever in which a body is formed by putting together the material of two bodies; for example, the case of a body formed by fusing together two lumps of metal.

the theorem employed by Professor Huntington involves a physical principle not explicitly stated by him, namely that *matter consists of individual particles, each of which preserves its identity and its mass throughout all physical or chemical changes.*

Those who believe that mechanics should be regarded as a physical science rather than a branch of pure mathematics will probably agree that in elementary instruction it is less important to build up a logical framework than to help the beginner to appreciate the physical meaning of dynamical laws.

L. M. Hoskins

Stanford University,
September 16, 1916

FLASHING OF FIREFLIES

To the Editor of Science: The notes by Mr. Edward S. Morse in Science for February 4 and September 15, 1916, on fireflies flashing in unison, have been of very great interest to the writer, in connection with his studies of the light-emission of American Lampyridæ,[1] and during the course of these observations he has constantly been on the watch for synchronous flashing of the type reported by Mr. Blair and by Mr. Morse. There seems to be no doubt that it is a fairly frequent, if not a constant, method of light-emission among certain tropical (mainly oriental) Lampyrids, but instances of it in our North American species must be fortuitous, at least in this locality. The writer's observations so far made have been on *Pyractomena borealis, P. lucifera, P. angulata, Photinus pyralis, P. consanguineus, P. scintillans, P. marginellus, P. castus* and *Photuris pennsylvanica.* In most of these there is now no doubt that the photogenic function serves as an attraction between the sexes for mating, and synchronous flashing of a large number of individuals would seem to be of such a nature as to interfere with this function of the light. Among the species studied, there would appear to be a possibility of anything approaching synchronous flashing only in *Photuris pennsylvania,* whose lighting habits it has been found difficult to follow accurately. On one or two occasions during the past summer observations were made by Mr. H. S. Barber, of the National Museum, and the writer, of what appeared to be the alternate illumination of adjacent trees in which this species was present in abundance, but it was soon evident that while at a given instant one tree may have been more highly illuminated than the other, there was nothing approaching periodicity in the phenomenon, and no continuation of it was noticed. Of course, special conditions of temperature, moisture, air currents, etc., might influence these insects in such a way as to produce synchronous flashing, but although especially watched for, we have been unable to secure an observation of it. If any other observations of this character have been made on North American species of Lampyrids, the writer would be very glad to hear of them.

In regard to the synchronous head movements of ants, referred to by Mr. Morse as having been reported by Cox, it may be noted that one of our common web-worms exhibits a very similar conduct, a stimulus, such as a shadow passing over the colony, being sufficient to cause all of the caterpillars to jerk the head and forward segments from side to side, the great majority of them to the same side at the same time.

F. Alex. McDermott

Washington, D. C.,
September 20, 1916

OCCURRENCE OF YELLOW LEAF RUST OF WHEAT (PUCCINIA GLUMARUM) IN THE SALT LAKE VALLEY, UTAH

On June 23, 1915, the writer and one of his assistants, Mr. W. W. Jones, collected an apparently new rust on wheat in several fields north and west of Ogden, Utah. It was noted that the infection was very serious and in some instances the fields had the appearance of suffering greatly from drouth. A careful examination, however, showed that this condi-

[1] *Canadian Entomologist,* 1910, Vol. 42, p. 357; 1911, Vol. 43, p. 399; 1912, Vol. 44, pp. 73, 309; *Zeitschrift fuer wissenschaftliche Insektenbiologie,* 1914, Vol. 10, p. 303.

tion was due to the rust, the uredo stage of which was just beginning to make its appearance. The specimens were put away and were not again examined until a short time ago when it was decided to make a proper identification of them. When they were taken it was our intention to revisit the fields and collect the teleuto stage, but owing to press of other work this was not done. When a reexamination of the material was made we found it impossible to determine the species and a sending was therefore made to Mrs. Flora W. Patterson, mycologist, U. S. Department of Agriculture, Washington, D. C. The tentative opinion of the writer, that the rust in question was none other than *Puccinia glumarum* Eriks. and Henn., has been confirmed both by Mrs. Patterson and the pathologists in the Cerealist's Office at Washington.

Just two days previous to our finding this rust, Dr. F. Kolpin Ravn, of Copenhagen, Denmark, Mr. A. G. Johnson, of the University of Wisconsin, and Dr. H. B. Humphrey, of the U. S. Department of Agriculture, visited the Salt Lake Valley and were undoubtedly on the lookout for this rust which was seen for the first time in this country at Sacaton, Arizona.[1] The writer had the pleasure of entertaining these gentlemen during this visit, making with them a short automobile tour about the valley in the interest of cereal diseases.

The rust infection due to *Puccinia glumarum,* as noted in the Salt Lake Valley, is undoubtedly of greater economic importance than had hitherto been supposed. It is not known to what extent the wheat crop was injured, but it is the writer's opinion that the loss over a considerable area must have been quite heavy if the extent of the infection could be taken as a criterion. During the present season careful notes will be made on the occurrence, distribution and effect of this rust on wheat in the Salt Lake Valley and adjacent districts.

P. J. O'GARA

DEPT. OF AGRI. INVESTIGATIONS,
AMERICAN SMELTING AND REFINING CO.,
SALT LAKE CITY, UTAH,
June 10, 1916

[1] SCIENCE, N. S., Vol. XLII., No. 1071, p. 58.

IS INHERITANCE MODIFIED BY ACQUIRED CHARACTERS?

IN the *American Naturalist* for August, 1916, I find an interesting article by Dr. C. B. Davenport, on "The Form of Evolutionary Theory that Research Seems to Favor." The general result of his investigation is "that the course of evolution is chiefly determined by internal changes," that is, by genetic changes. He, however, reminds us that "there is some evidence . . . that the germ plasm is not beyond the reach of modifying agents. At least we must continue experimental efforts in that direction."

The question which I wish to raise is whether attention has been given to the book by Walter Kidd, entitled "The Direction of Hair in Animals and Man," published by Adam and Charles Black, London, 1903. On pages 76 and 81 will be found pictures showing the difference in the arrangement of hair on the head of the chimpanzee, and that found on the heads of many young human subjects, who seem to have inherited some of the new arrangements through the influence of the artificial parting of the hair, practised by their ancestors for several generations. If these pictures correctly represent inherited conditions, it seems impossible to attribute them to spontaneous variations, uninfluenced by habit, and preserved simply because they gave their subjects superior power in the struggle for life, or because of any other form of selection.

For several years failing eyesight has restricted, not only my own investigations, but my knowledge of what others have accomplished; and I shall be thankful for any information as to whether these points have been discussed in the *American Naturalist,* or in any of our scientific journals.

JOHN T. GULICK

HONOLULU, T. H.

TUMORS IN PLANTS

AT last I have succeeded in producing small tumors in plants without the use of the crown gall organism (*Bacterium tumefaciens*), *i. e.,* simply by means of substances which are by-

products of the bacterial growth. The tumors though small have been obtained repeatedly on several kinds of plants and there seems to be no reasonable doubt that they are due to the fleeting chemical stimulus which I have applied. Judging from my experiments, which have been continued for some months, the mechanism of tumor growth appears to be wholly one of changed osmotic pressures brought about by the metabolism of the tumor parasite. A full paper will be published as soon as I have finished studying my serial sections and have had time to make suitable photomicrographs to illustrate it.

Erwin F. Smith
U. S. Department of Agriculture,
Washington, D. C.,
October 17, 1916

QUOTATIONS

THE OPTICAL INDUSTRY IN FRANCE

A series of articles by various authors has recently been appearing in the *Revue générale des Sciences* on the methods to be adopted for the development of French trade after the war. Amongst these have appeared two articles (May 30 and June 13) by M. A. Boutaric on the French optical industry and its future.

He points out that before the Napoleonic wars France had been dependent on England for its optical glass, and it was as a result of the British blockade that its manufacture was commenced in France.

At the present time the house of Parra-Mantois manufactures practically all the special optical glasses made by Schott and Co., and the French makers undoubtedly are more successful than their competitors in the manufacture of the glass discs required for very large astronomical mirrors and objectives. In every branch of optical science French physicists have invented instruments and methods for testing their qualities, but the French manufacturers have not done themselves justice by an efficient catalogue propaganda. M. Boutaric, when referring to the firm of Zeiss, mentions especially that it "has surrounded its products with a scientific propaganda." He shows how severe the German competition in microscopes was before the war, although there are two good French makers—Nachet and Stiassnie. The metallurgical microscope of Le Chatelier has been developed by Pellin with considerable success. The polarimeter in its present commercial form was developed by the French makers Soliel and Laurent, and is essentially a French instrument, yet the German houses have almost obtained a monopoly in the sale of the instrument outside France.

The manufacture of binoculars is the most successful of all the French optical industries, several large firms (Balbreck, Baille-Lemaire, Société française d'Optique, Société des Lunetiers, etc.) being employed in their manufacture. As showing the large quantity of optical glass used in these glasses, it is stated that the Société des Lunetiers alone use about 200,000 kilos of glass annually.

Although French makers showed several prism binoculars of the Porro type at the 1867 Exhibition, yet the manufacture of these glasses passed almost entirely to Germany. Now, however, glasses equal to the best German models are being made in France in large numbers for her army and those of her Allies. The original supremacy of the French photographic lens has passed away, because, in the opinion of M. Boutaric, the French makers did not use the new glasses and modern grinding methods, nor sufficiently avail themselves of skilled technical knowledge. M. J. Richard has developed with great skill and success a stereoscopic camera, the "Verascope," and also a very rapid camera shutter, but the majority of the cameras used in France have been imported. The kinematograph, the invention of a Frenchman, Professor Marey, has been carried to a high state of perfection by the firms of Lemaire, Pathé and Gaumont. To a certain extent France is dependent on outside sources for kinematograph film, but, on the other hand, she exports finished printed film to the annual value of £600,000. The lighthouse industry, built on the theoretical work of Fresnel, is a successful one, although it has had to face keen competition from English and German makers.

M. Boutaric points out that although in nearly all optical matters French savants are the pioneers, yet the French optical industry is very small as compared with the German. In an interesting paragraph he endeavors to analyze the reasons for this success. "Here, as in everything else, the Germans have been saved by their deep sense of business. The German industry demonstrates by a wise publicity the worth of its goods, sometimes excellent, but sometimes also copies of our models and inferior to ours; their catalogues, well edited and illustrated, are published in many languages, and give full details of the instruments they describe, their travelers, men of parts, knowing intimately their instruments . . . and trying to satisfy the wishes of their customers."

M. Boutaric points out that the collaboration between the man of science and the manufacturer is far more close in Germany than in France. In the former the man of science is in intimate touch with the works, and is well paid for his services. The foreman and apprentices are trained in the theoretical side of their subject in classes they are obliged to attend. In the firm of Zeiss half the time spent by the workers in the technical classes is counted as time spent in the works. No steps are neglected to perfect the organization as a whole; everything is done to make the machine independent of a single individual. In France the success and reputation of a firm have too frequently depended on one individual. That some steps are being taken to strengthen the optical industry in France is shown by the fact that a large factory has been built by La Société française d'Optique, formed in conjunction with the firm of Lacour-Berthiot, for meeting the competition of the best German firms. M. Boutaric urges that if the future of the industry is to be assured, new blood must be introduced, young mechanics trained, and a school of optics founded. This school, for which M. Violle has pleaded, should be divided into at least two sections: optics proper and photography. In it practical classes on glass grinding, etc., should be given in conjunction with theoretical work.—*Nature.*

SCIENTIFIC BOOKS

A System of Physical Chemistry. By W. C. McC. LEWIS. New York: Longmans, Green, and Co., 1915. 19 × 13 cm.; 2 vols. Pp. vii + 552; xiv + 523. Price $2.50 net, each volume.

In the preface the author says: "The scientific treatment of any set of phenomena consists in applying the minimum of general principles or theories which can afford a reasonable explanation of the behavior of matter under given conditions; and predict its behavior under new conditions. The principles referred to as far as physics and chemistry are concerned are the kinetic theory and thermodynamics. In the kinetic method of treatment emphasis is laid upon the actual molecular mechanism of a given process; in the thermodynamic method the emphasis is laid upon the energy changes involved. Both methods should be familiar to any one who undertakes the task of original investigation. . . . I have therefore divided the book into three parts, in which the phenomena exhibited by systems in equilibrium and not in equilibrium are treated first from the 'classical' kinetic standpoint only; then independently from the thermodynamic; and finally from the standpoint of thermodynamics and the new or 'modified' principles of statistical mechanics."

One obvious criticism of this plan is that the same subject is treated more than once, which seems a pity. The author has covered an enormous amount of ground. He takes up electrochemistry pretty thoroughly; he has one chapter on colloid chemistry, another on Nernst's heat theorem; a third on photochemistry, and a fourth on the quantum theory. In a sense it is therefore a pretty comprehensive treatise on physical chemistry, covering something the same ground as Nernst's "Theoretical Chemistry" but in more detail. The plan of the book is an ambitious one; but the task was rather more than the author could handle. The treatment is essentially not critical and the reviewer finds the book much less interesting and inspiring than Mellor's "Chemical Statics and Dynamics."

WILDER D. BANCROFT

ON THE ETIOLOGY OF EPIDEMIC POLIOMYELITIS[1]

By the combined use of methods employed by Rosenow in a bacteriologic study of various diseases including diseases of the nervous system and the methods of Flexner and Noguchi in their study of poliomyelitis, we have isolated from all of 52 cases of poliomyelitis a peculiar streptococcus. This organism has been obtained from the throats, tonsils, abscesses in tonsils and from the central nervous system. It has been obtained from the ventricular fluid after death, but not from the spinal fluid during life. In only one instance has it been isolated from the blood during life.

In seventeen fatal cases the tonsils showed from one to fifteen abscesses. These were situated near the capsule and contained a peculiar gelatinous opalescent material from which this peculiar streptococcus was isolated in large numbers.

The microorganism is remarkably polymorphous, appearing to grow large or small according to the medium on which it is grown. Details as to its growth on various media may be found in the *Journal* of the American Medical Association for October 21, 1916. In general, it may be said that under aerobic cultivation and in dextrose-containing media, the organism tends to grow large, while in ascites fluid in tall tubes containing tissue, the small forms predominate. The latter appear to be identical with the microorganism described and cultivated by Flexner and Noguchi.

Cultures of Berkfeld N filtrates of emulsions of brain and cord of rabbits which died of paralysis after intravenous injections of suspensions of broth cultures showing only the large forms have repeatedly grown out in suitable media. The microorganism has been grown also from the filtrates of cultures showing the small form but not from filtrates of cultures showing only the large form. It has been isolated from the brain and cord of paralyzed monkeys following intracerebral injection of fresh human virus and glycerinated human and monkey virus.

The large form of the organism, injected intravenously or intracerebrally, has produced paralysis consistently in animals (rabbits, guinea-pigs, dogs, cats) which are known to be quite insusceptible to inoculations by the methods which infect monkeys—injection of emulsions of brain and cord from patients with poliomyelitis. After producing paralysis consecutively in three rabbits one strain caused characteristic paralysis and lesions of poliomyelitis in monkeys.

The cords of paralyzed animals have shown lesions very similar to those of experimental poliomyelitis in monkeys: hemorrhages and round-cell infiltration in the gray matter, as well as degeneration of the ganglion cells and neurophagocytosis.

Lesions, other than those in the central nervous system, were relatively few, but when present were most commonly found in lymph glands, the spleen, lymphoid structures in the intestinal tract, particularly in the colon and in the splanchnic region. Pure cultures of the organism have been obtained from the central nervous system in numerous animals when blood and other tissues were sterile.

It appears that the small filterable organism of Flexner and Noguchi which has been generally accepted as the cause of poliomyelitis is probably the form which this streptococcus takes in the central nervous system and in suitable culture media under anaerobic conditions, while the larger, more virulent and more typically streptococcic form which other investigators have considered contaminations is the same organism grown larger on suitable media. The larger forms may play an important part in the epidemiology of poliomyelitis.

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[1] From the laboratories of the Mayo Foundation and the New York Hospital. Presented before the Minnesota State Medical Association, Minneapolis, October 13, 1916.

HUMAN REMAINS FROM THE PLEISTOCENE OF FLORIDA

IN a paper recently issued the writer has given an account of the occurrence at Vero on the Atlantic coast in central-eastern Florida, of fossil human remains in association with extinct vertebrates.[1] Human remains have been found at this locality in two separate strata which differ in age, the one being superimposed upon the other. The older of these two beds is unmistakably of Pleistocene age, and it is from this bed that the new material now to be described has been obtained. By this new evidence, as well as by that previously given, it is definitely established that man was present in America in association with a Pleistocene vertebrate fauna. Of the mammalian species of this fauna a few, including chiefly small inconspicuous animals, have persisted to the present time, while the larger animals, including the elephant, mastodon, camel, horse, bison, tapir and sloth have suffered extinction. With the exception of bison, which are native to North America, and horses which have been reintroduced from Europe and canids which are common to the old and the new world, the nearest existing relatives of these extinct species are now found in Central and South America, in Asia or in Africa.

The vertebrate fossils at Vero are found chiefly in an old stream bed and were discovered as a result of the construction of a drainage canal which extends from the coast some miles inland. The canal was made in 1913 and a number of vertebrate fossils, which had been thrown out by the dredge while excavating through the stream valley, were obtained at that time. Human bones, however, were not found until two years later, October, 1915, the first bones obtained having been exposed as the result of the lateral caving of the canal bank. A second discovery of human remains was made in April, 1916, and a third in June, 1916. The present paper relates to the latest of these discoveries, the earlier finds having been described in the publication to which reference has been made.

[1] *Amer. Jour. Sci.* (4), XLII., pp. 1–18, July, 1916.

At the time of the discovery of the vertebrate fossils at Vero, the writer suggested to those who were collecting there the importance of keeping a close watch for associated human remains. The subsequent discoveries are to be credited very largely to the patience and persistence of Messrs. Frank Ayers and Isaac M. Weills, to whose careful observations at this locality during the past three years are due chiefly the important results that have been obtained.

A section through the stream bed at Vero is indicated in the accompanying text-figure. Number 1 of the section represents a marine shell marl which underlies a large area in eastern and southern Florida and is known from its invertebrate fauna to be of Pleistocene age.[2] Number 2 of the section consists of cross-bedded sand which at the top grades into a fresh-water marl, the whole stratum having an average thickness of from three to five feet. Vertebrate and fresh-water invertebrate fossils occur throughout this bed from the cross-bedded sands at the base to the marl rock at the top. The sand includes also partially decayed wood, and in places muck and plant fragments. It is from this bed that the human and other vertebrate fossils here described, as well as a part of those previously described, were taken. Number 3 of the section represents an alluvial deposit consisting largely of loose sand and muck which in places grades into a fresh-water marl. The average thickness of this later bed is about two feet, although in places it reaches a maximum of five or six feet.

Between the marine marl, number 1 of the section, and the sand and marl stratum holding human and other vertebrate fossils, number 2 of the section, there exists no persistent well-marked break in deposition. There is, however, a change from marine to fresh-water conditions, and accompanying this change one

[2] To this extensive deposit of marine shell marl bordering the Atlantic coast, the writer in 1912 applied the term Anastasia formation, this name having been selected because of the fact that the shell marl was first quarried and described on Anastasia Island near St. Augustine, where it is known as "Coquina." (Fla. Geol. Surv. Fourth Annual Report, p. 18, 1912.)

finds evidence of stream action, materials from the land having been washed in and deposited in channels in the marine shell marl. On the other hand, there are places in the section where the sand and shell beds of the marine deposits dove-tail into the succeeding fresh-water deposits in such a way as to indicate continuous deposition. It is probable that the fresh-water deposit indicated by number 2 of this section, represents at this locality the closing phase of the marine marl formation, the change to fresh-water conditions having been brought about by a slight shifting of the strand-line.

Between this older formation and the alluvial bed which follows, number 3 of the section, there is, on the other hand, an abrupt well-marked persistent break, the top surface of the stratum represented by number 2 being extremely irregular. The alluvial bed, the initial phase of which is represented by pronounced stream action, conforms to the irregularities of the older formation. In this later bed, number 3 of the section, is found human skeletal remains, bone implements, pottery, arrow-heads and ornaments.

HUMAN REMAINS

The first skeletal remains of man found at Vero, an account of which has previously been given, were from the bone-bearing bed represented by number 2 of the section and were taken from the south bank of the canal at the locality indicated by *a* in the accompanying text-figure. The additional human bones to which the present paper relates were found in place while excavating in the south bank of the canal at the locality indicated by *b*. At the spot where the human bones were found, owing to stream-wash previous to the deposition of the overlying deposit, the fresh-water stratum, number 2 of the section, is only about 18 inches thick. The human bones were found in this sand, about 10 inches above the base. The overlying alluvial beds are stratified and as usual conform to the irregularities of the underlying formation. The human bones at this place were found and removed by the writer, in the presence and with the assistance of Isaac M. Weills and Frank Ayers. The first bone found was a right astragalus; the second bone taken in place was the right external cuneiform, which lay at the same level and about six inches from the astragalus. About twelve inches farther back in the bank was found a piece from the right pubes and a part of the left ilium including that part of the bone which shows the articular surface for the sacrum. In the same stratum and at the same locality Mr. Frank Ayers found in place a thin sharp-edged flint which evidently is a spawl from the manufacture of some kind of a flint implement. Upon sifting the sand in which these bones were imbedded there was obtained two phalanges, a section from a limb bone and some other human bone fragments. In these siftings there was found also a small flint, worked on one side, two small spawls, and a piece of a bone implement.

Vertebrate fossils in immediate association with the human bones, found in place in this stratum, number 2 of the section, include the following: *Odocoileus* sp., left scapula; *Elephas columbi,* tooth fragments; *Equus* sp., part of a tooth; *Tapirus haysii?,* part of a tooth, and *Didelphis virginiana,* part of a lower jaw. From the siftings the following additional species have been obtained: *Sylvilagus* sp., teeth and part of lower jaw; *Chlamytherium septentrionalis,* dermal plates; *Dasypus* sp., dermal plate; *Sigmodon* sp., teeth; *Neofiber alleni,* teeth; and *Cryptotis floridana,* lower jaw; as well as bones representing birds, reptiles, batrachians and fishes. Of these fossils the scapula of the deer was found within a few inches of the human astragalus and at the same level, while the other specimens were found near by, none of those listed being more than five feet from the human bones. From the same stratum, ten feet farther west, was obtained, upon passing the sand through a sieve, a small bone implement and a small flint which represents either a spawl or a very small flint tool. The vertebrate fossils found at this place include the following: *Odocoileus* sp., teeth; *Equus* sp., foot bone; *Dasypus?* sp., dermal plate; *Didelphis virginiana,* tooth; *Elephas columbi,* parts of teeth;

Chlamytherium septentrionalis, foot bone; and *Sylvilagus* sp., teeth. Among additional mammalian species known to pertain to this horizon are the following, all of which have been found in place in the canal bank in stratum number 2 of the section at Vero; *Megalonyx jeffersonii, Mammut americanum, Vulpes pennsylvanicus?, Equus leidyi, Equus complicatus, Smilodon* sp., *Procyon* sp., *Canis* sp. nov. and a peccary. Of these fossils the first three species listed were found with or near the first human skeleton obtained at Vero. Other species found at this locality and referred provisionally to this horizon include the following: *Equus littoralis, Hydrochoerus* sp., and a camel.

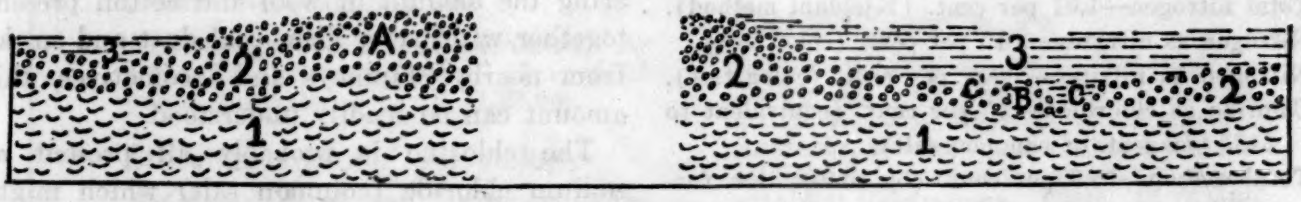

FIG. 1. Section showing strata exposed in the canal bank at Vero. Horizontal scale, 1 inch equals 50 feet; vertical scale, 1 inch equals 15 feet. The break in the sketch indicates the entrance of a lateral canal. Human skeletal remains are found at *a*, at *b* and at *c* and *c'*. The human remains at *c* and *c'* lie at or very near the contact line between 2 and 3. Those at *a* and *b* lie in the stratum represented by number 2 of the section.

If the bones representing these animals were found only in fragments and lay near the base of the bed, they possibly would be under suspicion of having washed into the deposit from an older formation. The bones, however, are distributed throughout the stratum from base to top. Moreover, the next older beds at this locality are marine and contain few land fossils. Of proboscidian remains there have been found in place in this stratum complete teeth and parts of tusks so fragile that they can be removed intact only with difficulty, while of the wolf, *Canis* sp., a nearly complete and fragile skull has been secured. Fossils of this character can not possibly represent reworked material. The species known to pertain to this horizon afford conclusive evidence of the Pleistocene age of the formation.

The appearance and degree of mineralization of the human bones is the same as that of the associated fossils. In addition the overlying deposits at this new locality are laminated and consist of alternating layers of sand and muck which could not have been dug through without affording evidence of having been disturbed. The possibility of the human remains representing a recent burial is thus excluded.

The conclusions that may be safely drawn from the data thus far obtained by this work in Florida may be stated as follows: Man was present in America in association with a mammalian vertebrate fauna that is universally recognized as being of Pleistocene age. With regard to culture, the men of the particular stage of the Pleistocene to which this paper relates were then making flint implements, a fact fully established by the discovery in place in the Pleistocene bed of a spawl from such an implement. They probably were also making bone implements, two of which have been obtained from screenings from the Pleistocene deposit. They apparently also had acquired the custom or art of engraving on bone, this conclusion being supported by the discovery in place in the Pleistocene bed of bones and of a proboscidian tusk having markings which seemingly were made by tools. Further support of this fact is derived from the presence in the formation of small flints obtained from screenings which may have served as tools for this purpose.

The human remains and the associated fossils are more fully described in a report soon to be issued by the Florida State Geological Survey.

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SPECIAL ARTICLES

THE ANALYSIS OF "DUST" COLLECTED IN A VACUUM CLEANER FROM THE BOOK SHELVES OF THE RENSSELAER POLYTECHNIC INSTITUTE LIBRARY

Microscopical Examination.—Hair, green wool, white wool, cotton fibers, fly wings, sand grains, wood, paper, string, celluloid, pieces of finger nails, metallic iron and leather.

Life in water suspension of dust (microscopically × 320), none.

Qualitative examination: Iron, aluminum, sodium and calcium.

Volatile matter—39.74 per cent.

Ash—60.26 per cent.

Silica—14.18 per cent. (hydrofluoric acid test).

Total nitrogen—1.01 per cent. (Kjeldahl method).

Nitrogen as nitrates—.015 per cent. (color test).

Nitrogen as nitrites—.0001 per cent. (color test).

Chlorine as chlorides—.15 per cent. (equivalent to .2485 per cent. of common salt).

Total carbon—15.9 per cent. (by combustion furnace).

Nutrient jelly, total bacteria count (average of 6 plates)—318,000 per gram.

Lactose litmus agar, total count—9,000 per gram.

Bacillus coli communis—present (lactose bile).

Bacteria counts were secured from one gram of the dust shaken with sterile water.

THE ANALYSIS OF LIBRARY DUST

The floor of the library is of Torazzo and the book shelves are made of sheet steel painted with gray zinc paint.

The microscopical examination of the dust showed human hair and other hair probably derived from soft hats. There were likewise wool and cotton fibers from clothing, sand from the mud tracked in on shoes and the gradual pulverizing of the floor; fly wings from dead flies and paper from book leaves. The remaining articles present explain themselves. In a water suspension of this dust no life could be detected with a lens magnifying 320 diameters.

The elements found in the qualitative examination come chiefly from the wear and tear of the floor and walls; the latter being coated with plaster of Paris probably accounted for most of the calcium. Mud tracked in would account for some of the iron and aluminum present. The sodium found was due to the wear of the floor as well as perspiration from the handling of the books. Metallic iron was furnished by the nails in shoes and was removed from the dust by the use of a magnet.

The low per cent. of volatile matter, 39.74 per cent., is due to organic materials such as wool, cotton, shoe leather and rubber heels. The high ash, however, is accounted for by the compounds of iron, aluminum, calcium and silicon present as well as by the metallic iron noted above.

The total carbon content is high, but considering the amount of wool and cotton present together with paper fiber, coal dust and smoke from nearby chimneys and locomotives, this amount can be readily understood.

The chlorine is probably all present as sodium chloride (common salt) which might come, as stated above, from perspiration left on the books and mud carried in on shoes.

The total nitrogen is high, the nitrates and nitrites low, hence the nitrogen must be present almost entirely as nitrogenous organic materials such as hair and other fixed organic compounds.

The *Bacillus coli communis* was found. It may come from several sources, the most probable one being the hands while handling books. The bacillus might also be present because of the coughing, sneezing and possible expectoration of people using the library.

The total number of bacteria in the dust of such a confined space as a library would naturally be high, as the dust would catch the bacteria and have a tendency to hold them.

One of the chief points of interest connected with this analysis is the presence of *Bacillus coli communis*. Where this organism survives, more harmful bacteria might also remain, such as those producing typhoid fever, cholera, diphtheria and especially tuberculosis, which latter disease is caused by a bacillus especially able to resist the sterilizing influence of drying.

R. R. Rees